A STUDY ON THE SOCIAL IMPACTS OF OFFICE AUTOMATION

DEPARTMENT OF COMMUNICATIONS
GOVERNMENT OF CANADA

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CHAPTER ONE THE CONTEXT: AUTOMATION AND GROWTH IN THE INFORMATION SECTOR

1.1 Terms of Reference

This report is an overview of the social issues that relate to office automation. The introduction of computer-based technology is expected to bring major changes to the workings of the traditional office: applications extend from word processing (already widespread in North America), to the management work-station and the complex concept of the "integrated" or "automated office".

The "automated office" emphasizes computerization in the jobs of "white collar workers" -- those managers and professionals (as opposed to clerical staff) whose salaries account for the bulk of operating costs in the office. Multipurpose desktop terminals, whose user-friendliness may perhaps be increased by voice features, will connect individuals to each other, to computerized files, and to shared computing resources and peripheral equipment. Specialized applications will support the particular needs of the professional or manager. Proponents of automation predict that the direct use of automated tools by these "knowledge workers" in the office will bring productivity gains that have been unprecedented in this traditionally labour-intensive place of work.

The basic characteristics of the integrated office are illustrated in Exhibit 1-1, and major applications of the technology are listed in Exhibit 1-2. Articles and reports about office automation abound; this study considers only the social concerns relevant to automation in the office.

This work was supported by the federal Department of Communications (DOC). In November 1980, with co-operation from the Department of Industry, Trade and Commerce, DOC initiated a joint government/industry Office Communications Systems (OCS) program, aimed at developing a Canadian industrial capability in the office automation area. It is also a responsibility of this program to consider the potential social effects of office automation.

EXHIBIT I-1
CHARACTERISTICS OF THE INTEGRATED OFFICE

1. Connected Communications

The integrated office essentially becomes an interconnected workspace, using electronic media for communications among individuals and for access to shared resources.

2. Shared Resources

Through telecommunications, individuals make joint use of computer-based resources, for:

a) shared logic, i.e., the use of central computing resources, for text processing, data processing, etc.

b) shared file storage, for information retrieval, data processing, computer conferencing, etc.

c) shared use of peripheral equipment such as printers, optical character readers, etc.

3. Multifunctional Terminals

Multiple applications are accomplished through a single, multifunction terminal. The degree of independent capability in the terminal, as opposed to its reliance on a central computer, may vary considerably.

EXHIBIT 1-2

APPLICATIONS AREAS IN THE INTEGRATED OFFICE

1. TEXT PROCESSING

2. INFORMATION RETRIEVAL - from both internal and external data bases.

3. MESSAGING

4. COMPUTER CONFERENCING - on-going group collaborations using shared computer files.

5. DATA PROCESSING

6. PROFESSIONAL SUPPORT - the use of specialized applications by a professional to accomplish his or her work. For example, the use of interactive graphics hardware/software by engineers.

7. ACTIVITY MANAGEMENT - calendaring, scheduling, etc.

8. GRAPHICS DISPLAY

The main purpose of this project is to identify relevant social issues in an initial report; future work may address specific issues in more depth. A second emphasis has been placed on the discussion of methodologies relevant to future research. Since the OCS program includes a number of field trials of automation in government offices, particular attention has been given to research methods for field trial settings.

The collection of information concerning any new computer/communications technology does not lend itself to traditional research methods, such as bibliographic searches -- the material required is too new and does not fit into traditional categories. The research task in this case was made more difficult by the fact that our investigations could not be rigidly confined to office automation research; our topic, in practice, extended to the social issues that relate to the introduction of new technologies in general.

Most of our research activity, including a literature search, proceeded through referrals and direct contact with individuals and organizations in order to:

a) identify their concerns, approaches and relevant work;
b) gather material about the issues themselves.

Special effort was made to draw upon as broad a range of opinion from those working in related areas as time permitted. We regret neglected sources; there is no well-defined sample population for such research.

The structure of this report is as follows:

Chapter One - "Automation and Growth in the Information Sector". This chapter places office automation in the larger setting of certain economic shifts in society. It discusses in particular: growth in the service sector; the increasing importance of an "information sector" (and its unclear relation to service sector statistics); and the possibility of a divergence in society.

between those well-suited to an information-based economy and those poorly suited to it.

Chapter Two - "The Relevant Issues", provides an overview of the diverse issues that relate to office automation.

Chapter Three - "Two Major Constituencies". This chapter discusses two communities of interest particularly concerned with the impacts of office automation: women's organizations and organized labour.

Chapter Four - "Present Examinations of the Issues", will identify the main subjects which have been taken up as research examining the impacts of automation (i.e., predictions of job loss, etc.). It will also identify centres of activity such as relevant government departments, women's organizations, labour organizations and centres of research. A specialist list of individuals and organizations dealing with the impacts of office automation is included as an Appendix.

Chapter Five - "Applied Approaches and Research Methodologies". This will discuss macro and micro approaches to the study of office automation impacts. It focuses first on two applied approaches: QWL (Quality of Working Life), and sociotechnology. Then a review of the methods and procedures which can and have been applied to assess automation and to evaluate impacts is provided. It will examine the problems inherent in various approaches and provides examples of ways to measure impacts resulting from the introduction of automated systems in the office. The final part of this chapter provides recommendations for the design

of procedures for the evaluation and assessment of social impacts arising from office automation.

Chapter Six - "Conclusions and Recommendations". This identifies areas where further investigation appears most needed at this time. Recommendations are made regarding both general research initiatives and studies in the field trial setting. Larger policy implications which have emerged during this examination of social issues are also briefly discussed.

This project does not include matters of occupational health and safety. It is expected that other research efforts will investigate this area, particularly where questions of possible harm from exposure to video display terminals remain unanswered.

1.2 Dual Employment Effects

It is clear that two disparate populations exist in the office workplace: the managerial/professional "knowledge worker" population, and clerical support staff. This is perhaps the most essential point regarding the impacts of new technology: effects may differ substantially for each of these two groups, and in some cases a polarization of effects is anticipated. Differences within a dual labour market are particularly serious if employment opportunities are enhanced for the knowledge worker group, while they become restricted for the clerical support staff.

The overriding concerns about the impacts of automation have centered upon employment effects, and, while considerable debate has occurred whether net job losses will result as the automation spreads or whether new opportunities will offset job losses, there has been a general concensus that large-scale occupational displacements are to be expected. It is in this context that the possibility of a dual labour market becomes most disturbing, if job mobility is experienced by the

mangerial/professional group, while the predominantly-female clerical group finds their jobs reduced without replacement.

Office automation, however, is not occurring in isolation; nor can jobs or the economy in general be expected to remain static. It can be argued that job displacements are a natural part of the evolution of a healthy economy, and can be expected to occur as new areas of growth develop.

The remainder of this chapter places office automation within the context of broader trends in the economy, focussing on new areas of growth and changing skill requirements.

Broad sectoral shifts in the economy have been discussed within two related frameworks. One has distinguished the primary (agriculture, mining, etc.), secondary (manufacturing and construction), and tertiary or service sectors; the other defines a fourth "information" sector in the economy. Both frames of reference are discussed briefly here.

1.3 Trends in the Service Sector

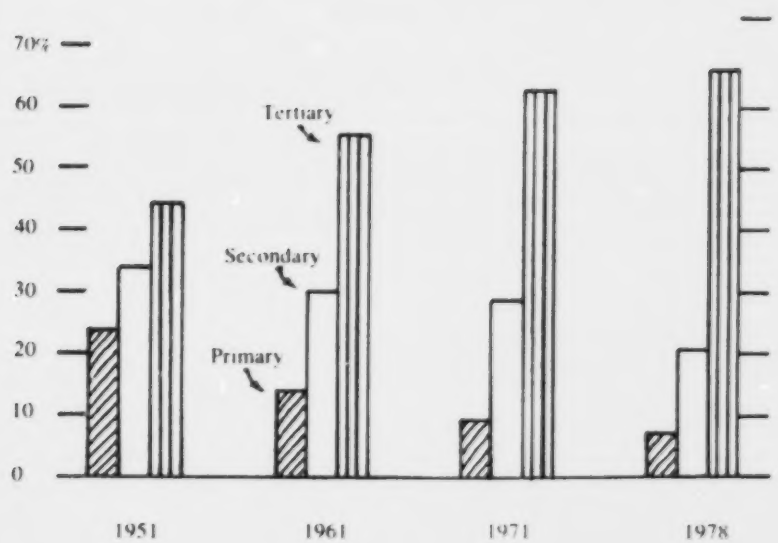
1.3.1 Growth in the Past

Exhibits 1-3 and 1-4 indicate that the "tertiary" or "service" sector has grown strikingly in recent decades, accounting for an increasingly dominant share of overall employment in Canada. Labour displacement, as agriculture and manufacturing adopted new technologies, was offset by the rapid expansion in the service sector, where employment growth centered. Between 1946 and 1977, while employment in Canada more than doubled, almost 90% of the employment growth was accommodated for by the expanding service sector.

EXHIBIT 1-3

EMPLOYMENT BY MAJOR INDUSTRIAL SECTOR, CANADA, 1951-1978

(percentage of total employed)



Source: Menzies, Women and the Chip, 1981, p.8.

EXHIBIT 1-4

INDUSTRIAL COMPOSITION OF EMPLOYMENT GROWTH

	Average Annual Rates of Growth			Per cent Contribution to Overall Employment Growth							
	1956-66	1966-73	1973-79	1956-66	1966-73	1973-79	1980-85			1986-90	
							A	B	C*	A	B*
Primary Goods	-2.9	-1.7	1.2	-16.6	-5.4	2.9	4.1	3.7	2.5	6.5	6.8
Mining	0.9	2.1	4.3	0.6	1.0	2.1	1.0	0.9	3.2	3.0	3.4
Other Primary	-3.5	-2.4	0.4	-17.2	-6.4	0.7	3.1	2.8	-0.7	3.5	3.4
Secondary Goods	2.8	2.1	2.3	32.5	20.4	19.4	23.7	22.4	18.5	18.9	19.9
Manufacturing	2.6	2.1	1.8	23.7	15.9	12.2	17.7	16.2	8.8	12.2	12.7
Construction	3.5	2.2	3.8	8.8	4.5	7.2	6.0	6.2	7.7	6.6	7.1
Services	4.2	4.4	3.8	84.1	85.0	77.7	72.3	73.9	81.0	74.6	73.3
Total	2.6	3.1	3.2	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Based on Statistics Canada, Labour Fource Survey.

*Alternative scenarios.

Employment and Immigration Canada, Labour Market Development in the 1980's, (1981), pp.24, 51.

A partial breakdown of the service sector is given in Exhibit 1-5, in the standard categories used by Statistics Canada and reflected in most studies. It is a confusing sector, grouping together personal services (laundry, hair salons, garages, etc.), retail sales, restaurants, banking and financial services, real estate, insurance, transportation and utilities, communications, health, education, research and government.

The growth of this sector can be attributed to several factors:

a) the sharp rise in public administration;
b) the growth in education and financial institutions; and
c) a generally low level of productivity, resulting in higher employment rates.

1.3.2 Present Automation

This last factor is causing concern about the continued expansion of the service sector. It has served traditionally as a coffer of jobs when, in other sectors, productivity increased and employment levels dwindled. The service sector may, in fact, have modified the impacts of previous waves of technological change by absorbing excess workers. Now, as automation (including office automation) is applied to the service sector and productivity increases, worries are expressed as to where labour-absorbing employment can be found.

The potential negative effects of automation in the service sector are especially worrisome to the female labour force. Women are overwhelmingly concentrated in the service occupations, as Exhibit 1-6 indicates. In 1979, clerical, sales or service occupations accounted for two-thirds of all Canadian women in the labour force, and in May 1980 the service-producing industries accounted for 81% of all women in the paid labour force.*

* Menzies (1981), p. 7-8.

EXHIBIT 1-5

EMPLOYMENT IN CANADA BY INDUSTRY

SELECTED YEARS

	1946	1961	1976
		(Per cent)	
Goods			
Agriculture	24.8	11.3	5.0
Fishing, trapping, and forestry	2.3	1.7	.9
Mines, quarries, and oil wells	1.5	1.3	1.5
Manufacturing	25.3	24.0	20.3
Construction	4.7	6.2	6.7
Total	58.6	44.5	34.4
Services			
Transportation, storage, and communications[1]	7.9	9.3	8.7
Wholesale and retail trade	12.0	16.9	17.3
Finance, insurance, and real estate	2.6	4.0	5.2
Commercial services, education, hospitals, and church institutions	18.9	19.4	27.1
Public administration		5.9	7.2
Total	41.4	55.5	65.5

1 Includes utilities.

Source: B.W. Wilkinson, Canada in the Changing World Economy, (Montreal: C.D. Howe Research Institute, 1980) Table 3, p. 20.

Despite general agreement that automation is about to have a dramatic impact on the service sector, this remains a sector where significant economic and employment growth is anticipated. The federal government's major examination of labour counts on the service sector for future growth, as shown in Exhibit 1-4.* (There is little detail, however, as to where either industrial or occupational growth will occur).

1.3.3 Source of New Growth

One of the positive arguments concerning the employment impacts of new technologies is that lost jobs are offset by new gains, including new activities (usually services) facilitated by the new technology. For example, automation in the banking industry made possible a range of new banking services such as inter-branch banking, which in turn generated employment. Automation may "increase employment opportunities in occupations using the output of automated processes -- for example, market research."** Increased corporate competition, as companies become more efficient, requires consumer-service consultants, sales personnel, market analysts, etc. New occupations emerge within firms; new companies form to offer new services; legal and computer security tasks arise; and, as the automation process goes on, software and computer specialists thrive.

Thus, regarding office automation:

"There is a suggestion of retardation in the rate of increase in office employment, but also a strong suggestion of the emergence of services which could not have been produced by non-electronic processes, or it was uneconomical to produce them. The production of such services will generate employment in new areas of activity."***

Most of these examples, concerning both automation and new opportunity areas, relate to information-based activities.

* Employment and Immigration Canada, Task Force on Labour Market Development (1981).

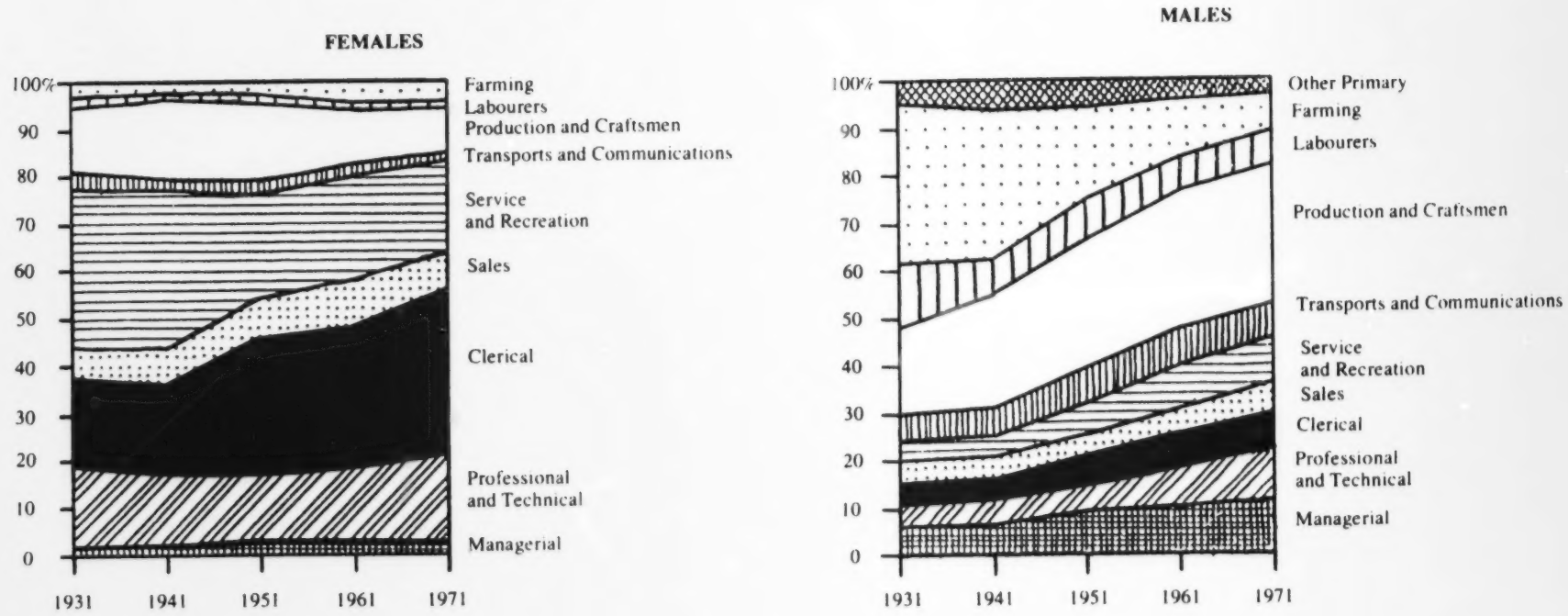
** Globerman (1981), p. 42.

*** Peitchinis (1981), (paraphrasing a report published in the U.S. in 1960.)

EXHIBIT 1-6

PROFILE OF MALE AND FEMALE LABOUR FORCE BY OCCUPATIONAL GROUPING, CANADA, 1931-1971

(percentage of experienced labour force, based on census data)



Source: Menzies (1981), pp. 9-10.

Yet these activities are poorly reflected in the standard categories for primary, secondary and service sectors, and within the service sector they are grouped confusingly with retail sales, personal services, transportation, health care, etc. A second framework, focusing upon information-based activities, has been developed in the past few years.

1.4 The Information-Economy

The use of such terms as "The Information Sector", or "The Information Society", has become common to refer to a society that is increasingly concerned with information, in addition to material goods, and where economic growth lies with "information" in its numerous forms.

Most obviously, the presence of information technologies has swelled dramatically. Computers have diffused throughout society as calculators, microcomputers and electronic games; the availability of TV signals is multiplying rapidly; industrial applications of computer-aided design and computer-aided manufacturing are steadily occurring, and teletext and videotex terminals may soon diffuse new information services.

The growth of information in society has also been discussed from a sociological stance. Daniel Bell wrote of the post-industrial society, organized by the centrality of theoretical knowledge. The economic sector shifts from goods-production to an economy in which health, education, research and government services are most important, and where a professional and technical class forms a new intelligentsia.

Empirical approaches have attempted to distinguish an information sector economically, adding to the classic distinctions between the agricultural, industrial and service sectors. This information sector includes information industries, i.e., enterprises primarily engaged in the production, processing, or distribution of information. Examples include publishing, education, advertising, consulting, market research, etc., plus the telecommunications industries which transfer information.

Pioneer work in delineating the information economy was done by Marc Porat at Stanford in 1974. Porat's "information sector" includes not only information industries and the equipment industries which support them, but also the information-based activities that take place in any enterprise. This would include, for example, electronic data processing, advertising, photocopying, secretarial work, telecommunications, correspondence, and so on, in firms in all sectors. These are sizeable activities: information occupations frequently absorb more than one-third of an industry's workers" (See Exhibit 1-7).

Porat found that the "information sector" showed a startling growth rate -- from 5% of the U.S. economy in 1870, to 24% in 1930 and 47% in 1970. He concluded:

"We are now an information economy. Over half of our wages and nearly half of our Gross National Product (GNP) originate with the production, processing, and distribution of information goods and services. But we have not yet, at a national policy level, realized how forcefully and irrevocably our economy has changed in the past 20 years."*

Porat's work generated a wave of international interest, and sensitized western countries to the dramatic growth of information-based economic activity. Several countries, including Canada, have stressed the importance of information sector industries for future economic growth and governments implemented high-level strategies to develop these industries (office automation industries being one example). The growth areas expected in the service sector lie precisely in new information-based occupations (See Exhibit 1-8).

There remains, however, a poor understanding of the information economy in the sense of information industries or in the information-based activities that take place in all industries** (Exhibit 1-9). In particular, there is a confusion between

* Porat (1976), p. 1.

** The Employment and Immigration Canada (EIC) labour market forecasts referenced earlier can serve as example. Despite a high growth in information occupations (Exhibit 1-8), the EIC report uses the standard primary, industrial and service sector categories, and information-based economic activity lies largely buried within the service sector.

EXHIBIT 1-7

PROPORTION OF INFORMATION WORKERS IN INDUSTRY

INDUSTRY	INFORMATION WORKERS %	NON-INFORMATION WORKERS %
Primary industries	9.7	90.3
Construction	25.0	75.0
Manufacturing	36.2	63.8
Transportation and communications	48.4	51.6
Trade	45.7	54.3
Finance, insurance real estate	90.9	9.1
Services	50.3	49.7
Government	53.0	47.0
Total industry	39.9	60.1

Source: Serafini and Andrieu (1981), p. 10.

EXHIBIT 1-8
INFORMATION OCCUPATIONS, 1931-1971

OCCUPATIONAL TYPE	PERCENTAGE OF THE CANADIAN LABOUR FORCE:				
	1931	1941	1951	1961	1971
Information Producers					
Scientific and technical workers; market research and co-ordination specialists (brokers, insurance agents, business salesmen, etc.); information gatherers (surveyors, inspectors); consultative services (architects, systems analysts, optometrists, accountants, lawyers, etc.); authors and composers			20.1	22.3	25.3
Information Processors					
administrative and managerial; process control and supervisory; clerical workers	3.5	4.1	4.4	5.7	7.5
Information Distributors					
educators, journalists broadcasters, and other communications workers	2.6	2.6	2.5	3.5	4.7
Information Infrastructure					
information machine workers, plus postal and telecommunications workers	1.8	1.8	2.3	2.6	2.4
All information occupations	21.0	22.3	29.3	34.1	39.9

	DECENNIAL GROWTH RATES			
	1931-41	1941-51	1951-61	1961-71
Information producers	23.5	36.1	59.3	75.6
Information processors	12.6	184.4	35.6	50.9
Information distributors	5.9	25.0	70.5	76.8
Information infrastructure	2.7	66.7	36.7	22.3
All information occupations	12.7	61.3	42.2	55.5
Total labour force	6.8	26.0	22.4	33.3

Source: Serafini and Andrieu (1981), pp. 7, 8.

EXHIBIT 1-9

INFORMATION-BASED ENTERPRISES AND ACTIVITIES

INFORMATION-BASED ENTERPRISES:

- information products and services
  - education, film and television, journalism, advertising, government departments, marketing consulting, on-line data base services, user software services and sales etc.
- telecommunications
  - the distribution of information products and services
- infrastructure
  - the provision of computer and communications equipment, automated office products, etc.
- microelectronics manufacture

INFORMATION-BASED ACTIVITIES WITHIN OTHER SECTORS:

Primary sector	Industrial sector	Service sector
agriculture	manufacturing	transportation, storage and communications
fishing, trapping and forestry	construction	
mining, quarries and oil wells		wholesale and retail trade
		57%*
		finance, insurance and real estate
	36%	commercial services education, hospitals, and church institutions
	25%	
		public administration
10%		

% of Information Workers, by Occupation (see Exhibit 1-7)

*average

the information sector and the service sector, which would include most information enterprises but which also includes personal services, retail sales, transportation, etc.

With the prevalent use of the service sector category and its close relation to the information sector (76% of information workers are employed in the service sector, where they account for over half the employees), further analysis is required to distinguish these two categories. The information sector must be understood more effectively, both to grasp the new opportunities that will emerge in the next 10 to 15 years, and to understand and prepare for the job losses that are likely to occur.

A broad growth in the information economy appears imminent. Yet, apart from the limelight shed upon a small number of high technology equipment firms, new growth areas are poorly defined. Only now, for example, is some study being given to the software industry.

Meanwhile, jobs are changing. Office automation, perhaps the major form of automation in the service sector, is more accurately viewed as an an information sector event. The office is the primary site of activity in the information sector: it is within offices that the information-based functions required by all firms takes place, and within offices that myriad information "products" from advertising to computer software to government documents are produced.

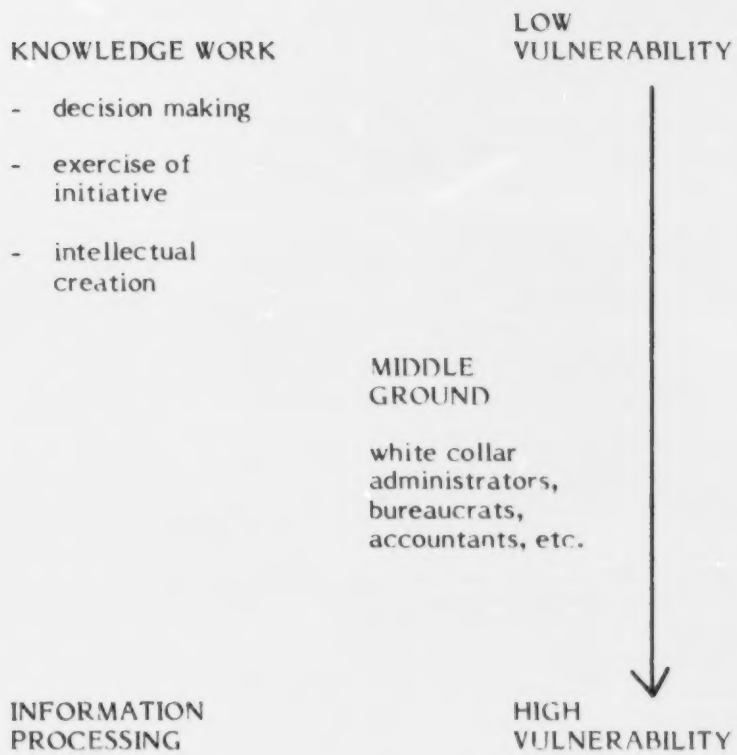
A close examination of the information sector reveals two trends:

1. there is a broad growth in this sector, producing new jobs; and
2. there is job replacement by technology as automation occurs.

The critical social questions which arise are those of job displacement and job mobility.

EXHIBIT 1-10

VULNERABILITY TO AUTOMATION IN INFORMATION-BASED JOBS



1.5 Occupational Displacement in the Information Sector

Three points are considered here:

1. the likelihood of occupational replacement by technology in different information sector jobs;
2. changing skill requirements for employment; and
3. job security.

1.5.1 Likelihood of Automation

The first wave of automation in the office was the introduction of word processing. Typing is a primarily mechanical task and one that can be segmented from the ongoing processes of the office. As such, it lent itself easily to automation.

The automation of information-based work depends largely upon two factors: the routine vs. the creative nature of the work, and the ease with which an activity can be identified, isolated, and broken off from the staff work-day. Unstructured tasks will be more difficult to automate. Thus the mix of creative or routine work in a job may become decisive: as Exhibit 1-10 suggests, "knowledge-based" jobs characterized by decision making, initiative, or intellectual creation will be most secure, while those which only process information will be most vulnerable. Exhibit 1-11 gives a schematic representation of the "qualitative" vs. the "repetitive" components of jobs.

For those whose jobs are difficult to automate, the computer may perhaps be a tool to help accomplish a range of tasks rather than a replacement for job functions. Thus, office equipment is marketed as a "multifunctional tool" for the "knowledge worker" -- the manager or professional whose job is considered to be knowledge-based.

EXHIBIT 1-11

POTENTIAL AUTOMATION OF KNOWLEDGE WORKER TASKS

INTEGRATED TASKS OF A SPECIALIST

-Perceive, Compare, Deliberate, Calculate, Write

Qualitative Fraction Repetitive Fraction

TECHNOLOGICAL CHANGE

Qualitative Fraction Repetitive Fraction

e.g. EDP

Necessity of
Higher Qualification

Danger of
Dequalification

POSSIBLE EFFECTS OF THE TECHNOLOGICAL CHANGE ON THE STRUCTURE OF THE SPECIALIST'S TASKS (SCHEMATIC)

Source: Warnecke, H.J., et. al,
"Effects of Social, Technological and Organizational Changes on the Labour Design as shown by the Example of Microelectronics Fraunhofer - Institute fur Producktionstechnik und Automatisierung, 1981.

Clerical work, meanwhile, usually involves the manipulation of information in some routine manner -- typing, transcribing, filing, copying, posting, etc., and thus these jobs are least secure.

Exhibit 1-6 profiled the male and female work force by occupation and emphasized the large concentration of women in the clerical category. They are concentrated generally in the service sector, which grew steadily through the last decades when women were entering the work force. Women are usually found in occupations where information manipulation and related clerical-type operations constitutes much of their work--secretaries, filing clerks, bank tellers, telephone operators, mail handlers, key-punch operators, etc. Women account for over 90 per cent of employment in most of these occupations.* Clerical work "has replaced domestic service as the pillar of female employment in Canada",** and clerical workers account for approximately one-third of all working women. In these jobs, women perform the most easily automated information-based activities.

Between the clerical level and the proverbial "knowledge worker" lies a vast middle ground of white-collar knowledge-worker employees, whose jobs consist of some mix of routine paper-handling plus thought work. There will be occupational vulnerability to automation in this group as well, as computerization seeks out and automates routine job functions.

* Menzies (1981), p. 1.

** Ibid., p. 8.

However, occupational vulnerability among white collar workers is unclear. Only now is thought being given as to what tasks are actually performed by the typical non-clerical worker. Furthermore, the possibility exists that once relieved of routine tasks, such employees may give their attention to the more meaningful tasks that their salaries reflect.*

The most immediate effects of office automation, meanwhile, will be felt at the clerical level.

1.5.2 Changing Requirements for Employment

The level of education required for most occupations today has been rising steadily, and the present increase in information-based activity can be expected to place more emphasis on education, skill, and "computer literacy".

As information-based activity grows and as automation of routine information tasks occurs, new opportunities will increasingly lie in the more complex knowledge-based occupations. Individuals will face more exacting skills and education requirements to enter these opportunity areas.

* The high proportion of "knowledge worker" time spent in "less productive" activities like filing, arranging meetings, etc. is an argument often advanced in favour of office automation.

Studies have pointed to rising skill levels due to technological change. A study in 1978 concluded that the effect upon education and skill requirements was critical in technological change, and anticipated a major increase in the proportion of employees requiring technical knowledge.* Similarly, a 1980 report on Innovation and Technological Change in Five Canadian Industries found that skill requirements were raised in 71% of the cases observed.** Meanwhile, a federal task force on work during the 1980s placed major emphasis on training and retraining needs.***

Accepting that job displacement will occur and that education and skill requirements will grow more exacting, the important question is: can displaced workers realistically be moved to new and more opportune occupations. The new employment areas created as automation occurs seem to lie in a different universe, separated from those displaced by a critical education gap:

> While computers and microprocessors displace production-line workers, they demand the services of programmers, information processors and similar people. In the service sector, word processors will eliminate a large amount of typing, while automated warehouses will force out clerks. But, at the same time, the need for software specialists and technicians will increase. Countries throughout the world are recognizing the need for retraining and education to improve worker mobility. They perceive education as an ever more necessary tool for bringing the population into the information age."****

* Peitchinis (1978).

** Demelto, P., McMullin, K., and Wills, R., (1980), p.163.

*** Parliamentary Task Force on Employment Opportunities for the 80's (1981).

**** Serafini and Andrieu, (1982), p. 31.

To repeat a rustic analogy, there may be no more reason to hope that the new technologies will provide jobs for those workers who are replaced than to expect that horses "displaced" by mechanical vehicles could have been employed in the burgeoning automobile industry.

In fact, a divergent effect may occur: while new jobs with increasing education requirements may well emerge, often a de-skilling of work may occur with automation among those who continue to perform the same tasks that are now largely or partially automated.*

1.5.3 Job Security

Job displacement places a new importance on retraining, and with the rapid rate of change brought by microelectronics, our conception of a life-long occupation or career may be altered. The idea of "continual" or "lifelong" training has arisen: areas of employment may shift so rapidly that an individual may change occupations several times; or, skills and education levels within an occupation may change so extensively that periodic upgrading is required.

The security experienced in selecting an occupation and in having employment will be weakened under such conditions. A high degree of skill or technical expertise in a specific area, for example, may only increase one's vulnerability if an occupation becomes obsolete. Flexibility takes on a new importance, and those who have a sound education are likely to be best adapted to shift into new information-based roles: ".. the ability to grasp new ideas and flexibility to adapt to new knowledge are paramount requirements".**

* For examples, see Peitchinis (1978), p. 73, or Taylor (1981).

** Peitchinis (1978), p. 151.

Job mobility, as opposed to job stability, becomes the new cornerstone of survival. Once again, a split picture emerges. To take extreme examples, on the one hand, well-educated individuals, at ease with information work, may change occupations readily and progressively, improving their worklife and profiting from the continuing development of an information-based economy. On the other hand, those in occupations with low skill levels, distanced from the new growth areas, may train and retrain only to find that their occupations do not lead to other jobs and yet can promise no security.

The larger trends examined here underline the possibility that a dual labour market in the information sector may emerge as:

1. job displacements impact clerical workers at the lower end of information-based work, while knowledge-based occupations expand and furthermore remain less vulnerable to automation;

2. a widening skills gap separates knowledge workers from clerical staff, and from non-information workers;

3. job mobility becomes increasingly important, but is most easily experienced among the knowledge-based group.

To take the extreme case, a certain type of individual may move to new and often more interesting work as job displacement occurs, may meet skill and education requirements readily, and may accept more frequent employment shifts in life as a challenge. This individual, whose work is more knowledge-based than routine, also holds complex jobs which are among the least vulnerable to automation. Office automation, in fact, is a new tool, to accomplish work more easily, to work from home in quiet off-hours, etc. This person is "computer-literate" and may already be familiar with computers at work or have a microcomputer at home.

The contrasting case is the individual to whom job "displacement" is a defeat, whose skills and education do not move them forward easily into new occupations, and for whom a change in occupation is a difficult and perhaps impossible transition. This person is not at ease with new information technologies; if

familiar with such technologies at all, his/her role will, in effect, be that of an operator working for the machine.

It is in the office that occupational segregation and skill barriers to occupational mobility will be seen most dramatically, as the gap widens between clerical-type information work and professional-technical-type information work.

The diverging society suggested here may not necessarily develop. A slow rate of change may avert it; education, occupational bridging, or careful training policies may all cushion the effects of automation; a new wave of economic growth may edge people into jobs that allow them to acquire skills once employed. Yet, particularly in an economic downturn, the possibility of a new inequality, with "haves" and "have-nots" based on information wealth, must be considered. The unequal distribution of opportunity becomes a basic concern.

1.6 Summary

The advances in productivity offered by office automation, particularly in a context of international industrial competition, offer substantial gains, and few commentators see a halt to automation as either a realistic or a desirable option. The ability of the technology to relieve individuals of mundane tasks, to augment their capabilities, save time, etc., are also widely appreciated. However, a number of potential negative effects of office automation have aroused attention and the subject of employment impacts has been especially controversial.

This chapter has considered office automation within the larger context of economic shifts in society. It has briefly discussed the past growth of the service sector and the increasing importance of the information sector. The service sector has absorbed the major share of labour market growth in the last decades, and in particular provided jobs for female workers. In large, this ability to absorb labour has been due to low productivity. Automation can therefore be expected to have dramatic impacts.

Many of the critical areas affected by automation in the service sector are more accurately "information sector" activities. That is, they concern information-

handling jobs. The information sector, to date, has been poorly distinguished from the more traditional "service sector" category. Office automation is viewed here as essentially an information sector event.

At the same time as automation occurs, the information sector is expected to be a substantial growth area in the future. Thus two contrasting trends in the information sector stand out:

1. overall growth producing new jobs;

2. job replacement by technology as automation (and particularly office automation) takes place.

As this process occurs, job displacement and occupational shifts in the information sector assume a central importance.

Automation, when applied to information activities, will begin with routine tasks. Occupations at the clerical level are most immediately vulnerable. In contrast, "knowledge-based" jobs (with components of decision making, initiative, and creative intellect) will increasingly be more opportune. Women in the office, meanwhile, are concentrated in the clerical positions, and clerical work makes up a large proportion of women's jobs.

It appears that with the impact of automation, a dual labour market in the information sector may emerge:

1. job displacements fall most heavily upon clerical workers, while knowledge-based occupations expand and are also less vulnerable to automation;

2. the skills gap widens between knowledge workers and clerical staff or non-information workers;

3. job mobility becomes increasingly important, but is most easily experienced among the knowledge-based group.

In brief, one sub-population may be well-suited to the knowledge-based areas where information sector growth is occurring, while a certain sub-population is poorly addressed.

The split labour market in the office is an especially tense division: the strata of occupations are evident, given the clear line between managers, professionals and clerical staff, and furthermore women are concentrated disproportionately in the clerical roles.

The next chapter discusses a range of social impacts associated with automation in the office. Underlying these effects remains an essential issue: the further splitting of the work force through automation into a dual labour market and the concentration of women in the less-privileged group.

CHAPTER TWO THE RELEVANT ISSUES

2.1 Diverse Issues Linked with Office Automation

The concept of social impacts of office automation includes a complex set of issues. This chapter will identify the major relevant issues, which for purposes of discussion are grouped according to three levels of impact. Exhibit 2-1 indicates:

1. Macro Level - Societal
2. Organizational Level
3. Individual Level

These three levels are linked by several factors. First, underlying the issues at all levels is the possibility of a diverging effect between the more and less well-positioned groups in a dual labour market -- a development discussed in Chapter One. Secondly, the need for training and retraining (discussed in 2.4) in response to job displacements is a concern at all levels. Thirdly, labour relations may link different levels: a union local acts as an intermediary between individuals and organizations, and unions as a whole may lobby government to reflect worker interests in policies at the macro level. The role of unions regarding office automation is discussed in Chapter 3.

EXHIBIT 2-1

LEVELS OF IMPACT OF OFFICE AUTOMATION AND ASSOCIATED MAJOR ISSUES

1. MACRO LEVEL - SOCIETAL LEVEL

   Major economic and social concerns:

   A. Employment Impacts
      i. Effects on jobs
         -layoffs
         -jobless growth
         -job displacement
      ii. Effects on occupations
         -occupational shifts
         -occupational segregation
      iii. Effects on skills requirements
         -rising skills requirements
         -emphasis on computer literacy
         -de-skilling
      iv. Increased job mobility
      v. Dual labour market

   B. Changed Social Patterns
      i. Reduced work time
      ii. Changing meaning of work
      iii. Work in off-hours and work from the home
      iv. Transportation/telecommunications trade-offs

2. THE ORGANIZATIONAL LEVEL

   A. Management and Organizational Control
      i. Changed authority structures
      ii. New forms of management
      iii. Changed role of middle level management
      iv. The use of measurement systems

   B. Organizational Structure
      i. Removal of levels
      ii. Two-tiered effect
      iii. More contract work
      iv. Changed importance of units

   C. Changed Hours and Place of Work
      i. Shift work
      ii. Off-hours work
      iii. Cottage industry work
      iv. Satellite work places
      v. Work from the home

EXHIBIT 2-1
(continued)

D. Career Pathing
   i. Managerial/professional employees
   ii. Clerical workers

E. Work Design

3. INDIVIDUAL LEVEL

A. Control
   i. Monitoring
   ii. Pacing
   iii. Automony: decision making and responsibility
   iv. Accountability
   v. Worker participation

B. Nature of Work
   i. Increased stress
   ii. De-skilling
   iii. Job interest/monotony

C. Job Meaningfulness

D. Career Development
   i. Appropriate pay benefits
   ii. Job security
   iii. Opportunity to learn and develop new skills
   iv. Opportunity to advance

E. Social Needs
   i. Communications networks
   ii. Balance between work and home
   iii. Provision of a group structure
   iv. Privacy

The use of such categories always represents to some extent an arbitrary partitioning. Issues identified at the organizational and individual levels are particularly closely linked, and approaches such as Quality of Working Life and sociotechnical analysis aim specifically to optimize the needs of both organizations and individuals. These approaches are discussed further in Chapter Five.

2.2 The Macro Level

Chapter One emphasized a number of issues related to office automation at the Macro-Societal level. Employment issues are the predominant social concern raised by office automation at this time. Chapter One focused on employment as essentially a problem of job displacement and occupational shifts within the information sector. While many jobs processing information are replaced with automated technology, at the same time overall growth in this sector is producing new jobs. However, there is a widening skills gap between those knowledge-based occupations where many new opportunities lie, and the clerical level where automation most readily replaces work. Occupational mobility -- increasingly important as the rate of change quickens -- is seldom found at the clerical level. Women are likely to experience occupational segregation and tend to be concentrated in clerical roles. The possibility of a problematic dual labour market emerges, in which opportunity is most readily found by a "knowledge worker" professional/managerial class and which eludes others, such as women at the clerical level.

The following section presents the discussion of a number of issues at the Macro level (as illustrated in Exhibit 2-2).

EXHIBIT 2-2

LEVELS OF IMPACT OF OFFICE AUTOMATION AND ASSOCIATED MAJOR ISSUES

1. MACRO LEVEL - Societal Level of Impact
   Major economic and social concerns:

   A. Employment Impacts
      i. Effects on jobs
         -layoffs
         -jobless growth
         -job displacement
      ii. Effects on occupations
         -occupational shifts
         -occupational segregation
      iii. Effects on skills requirements
         -rising skills requirements
         -emphasis on computer literacy
         -de-skilling
      iv. Increased job mobility
      v. Dual labour market

   B. Changed Social Patterns
      i. Reduced work time
      ii. Changing meaning of work
      iii. Work in off-hours and work from the home
      iv. Transportation/telecommunications trade-offs

A. Employment Impacts

In employment impacts, problems of both unemployment and "re-employment" are involved. The population of unemployed may rise through lay-offs, or through jobless growth. Both the duration and the frequency of unemployed periods are problems for the jobless.

In the process of finding new employment, employment adjustment issues arise -- i.e. the transitions of job displacement and the additional efforts necessary for occupational shifts. If occupational segregation occurs, limiting employment opportunities for one group and enhancing them for another, then questions of social equity emerge.

i. Effects on Jobs

-Layoffs. The actual termination of an existing job is the most direct form of employment impact.

-Jobless Growth. With jobless growth, an organization expands its activities without increasing staff. Though no jobs are "lost", the unemployed will fail to find new job openings.

-Job Displacement. "Displacement" implies that while individuals lose one job they will find further employment elsewhere. The problems faced are temporary unemployment and, possibly, a need for a change of occupation.

ii. Effects on Occupations

-Occupational Shifts. Due to large shifts in the economy, employment in certain occupations may be reduced. Workers who lose a job may find there is a lack of opportunity in their former occupations.

A shift to more opportune occupations may be required, and occupational bridging (counselling, training, etc.) becomes a paramount requirement. Occupational shifts encompass the problems of job displacement and a transition to a new type of work.

-Occupational Segregation. Mobility between occupations may be limited in two senses. First, certain occupations may develop few skills that can be used as currency to shift to a new occupation: i.e., an occupation may develop low-level skills which furthermore may be perceived by society as holding little worth; or it could develop highly specialized skills which have little usefulness elsewhere. Secondly, the skill and education requirements to enter certain new occupations may rise so high that entrance is tightly limited.

The problem of occupational segregation has been stressed from a women's perspective:

> The informatics technology that is threatening to reduce clerical employment is also stimulating employment in an expanding range of new professional and technical information-related occupations. The new jobs, however, are more demanding, posing a potential mobility problem to those being displaced from or finding no job openings in clerical work.*

The lack of occupational mobility that is experienced by women results from a number of factors: the concentration of employed women in a few relatively low-skilled areas; a skills gap between the clerical and professional levels; the lack of finances and limited free time (due to family responsibilities) to acquire new skills through self-development; and a tendency among employers and women workers themselves to doubt that the competencies of clerical staff can be extended beyond this level.

*Menzies (1981), p. 75.

iii. Effects on Skills Requirements

-Rising Skill Requirements. Automation may tend to increase skill and education requirements in many occupations. This is a social concern in the sense that certain sub-populations may lack either the capability or the opportunity to meet rising standards.

-Emphasis on Computer Literacy. Computer literacy is increasingly important to capitalize on opportunities within the information sector (as discussed in Chapter 1). The acquisition of a basic knowledge of computers and their capabilities is an essential first step to any knowledge-based career as computers diffuse.

-De-skilling. While skills requirements rise in some occupations, a de-skilling may occur with certain other jobs that are partially automated. That is, the computer will control most aspects of a process leaving relatively few bits of work for the individual to supply. The individual is left with a sense of "working for the machine". This de-skilling may further entrench certain occupation groups in a low-skilled category.

-Widening Skills Gap. The possibility that office automation will lead to widening the skills disparity between clerical and professional information work has become particularly controversial.*

*Menzies (1981).

iv. Increased Job Mobility

Trends in the economy and a more rapid rate of change may make occupational shifts more common. Individuals may face a new frequency in occupation and career changes. Jobs may offer less security, while a new value is placed on flexibility and the ability to make transitions, and on skills and education that facilitate transfer to new occupations. A lack of mobility will become more problematic as occupational shifts during the course of a typical worklife become more frequent.

v. Dual Labour Market

The issue of a dual labour market in the office, split between (1) clerical and (2) professional/managerial workers, in effect encompasses all the above social problems; the impact, however, falls upon one of the two groups. The clerical sub-population is most vulnerable to job effects such as layoffs or jobless growth; is most vulnerable to reduced opportunity within an occupation, to occupational segregation and has little chance of achieving the rising skill levels expected in new growth areas. Meanwhile, the second group (better adapted to knowledge-based work) finds itself more able to enter new opportunities and also hold jobs that are less vulnerable to automation. Perhaps more disturbing is the fact that women are concentrated in the less-privileged clerical sub-population.

B. Changed Social Patterns

A second set of impacts are broadly grouped here as changes in "social patterns". They relate to how and where people spend their time, their priorities and values, and to their fundamental feelings about work and other facets of life. While few sharply debated issues have emerged, there is a sense that over time automation will change work habits profoundly, and that our social patterns and values will in turn be altered.

i. Reduced Work Time

Reduced hours of work (a shorter work week, part-time working arrangmements, etc.) could result from office automation through efforts to share available job opportunities or through a direct reduction in work to be done. Questions follow as to how social behaviour will adjust and how non-work time will be spent. Increased leisure activities, education and training, "do-it-yourself" activity (encouraged by rising costs), and "informal economy" activities (e.g. bartered work) are some possibilities.

ii. Changing Meaning of Work

Reduced hours of work and more extensive unemployment may raise new questions about the meaning of work itself. Part-time employment may become more usual; periods of unemployment may more commonly occur in an individual's working life. Yet being employed is much more than a means to earn a livelihood; it is a source of self-esteem and provides an identity to individuals. The stigma attached to unemployment could be reduced -- or it could be intensified while esteem is concentrated upon an elite well-suited to find continuous work.

iii. Work in Off-hours and Work from the Home*

The tools of office automation may allow the flexibility of work in off-hours, and from the home in any place and at any time information resources are available.

At the clerical level, the possiblity of work done from the home, perhaps piecemeal, has prompted fears that women may be returned to isolation in the home and that a pool of lower-paid unorganized "cottage industry" labour may be exploited.

iv. Transportation/Communication Trade-offs

For some years there has been an interest in the possibility of substituting electronic communications for physical travel.** Teleconferencing (audio, video and/or computer conferencing) could reduce the need for inter-city and intra-city travel; electronic mail and shared information resources could allow small "satellite" offices to be established that are "remote" from a central location, so that employees do not need to commute to a downtown core. Some of the results of such changes in terms of organizational structure are considered in Section 2.3.

* These issues are further discussed in Section 2.3, "The Organizational Level".

** For example, see Telecommunications Policy, March 1982. The articles in the particular issue are devoted to the topic of transportation/communications trade-offs.

The ways in which this set of macro-level issues have been examined will be discussed in Chapter Three. Despite the optimistic projections of increased productivity and convenience which are expected to accrue from automation, there are as well a number of negative projections about its effect. Whether or not these concerns are justified will depend, to a large extent, on how well Canada fares in new opportunity areas, particularly in the information sector and on education to empower a capable interface with new skills that will be required. Success will depend on adjusting to a new economic age based on information sector strengths.

2.3 The Organizational Level

The impacts identified at the organizational level and those at the individual level (discussed in 2.4) are closely linked. For example, automation may change the hierarchical structure of the organization, which in turn will alter career pathing; the individual experiences change from the point of view of career development. Changes in organizational control, hours and location, and task design are experienced by the individual as changes in the conditions of work. Two approaches which aim to integrate organizational and individual needs are described in Chapter 5 (the QWL, or Quality of Working Life approach, and sociotechnical analysis). Increasing attention has been drawn to the interrelations between technology, job design, human needs and organizational needs.

When new technologies are introduced with limited attention to how the introduction is made and to training of users, negative results often occur. These results include: a rejection of the technical system; absenteeism; high turnover; low employee morale; and even an increased likelihood of employee crime and sabotage. The organization suffers from less knowledgeable and less committed employees. Crime and vandalism become particularly serious given the increased vulnerability of the computerized workplace.

The breadth of impact of an "integrated" or "electronic office" system makes it especially important to consider organizational effects:

> ...the implementation of an advanced office system involves a massive and far reaching intervention into the work system of an organization. Unless the designer and implementor are cognizant of the socio-technical nature of the system and the many 'organizational' and 'people' issues to be resolved, the system will likely fail.*

In the past, however, both negative and positive impacts on the organization appear to have often resulted in a haphazard way. Despite the very real likelihood that new technology will affect organizational structure and workings profoundly:

> ...neither those who plan the new systems or those who approve them, currently make much effort to anticipate their organizational consequences. Today the positive human effect of the technology are as likely to be accidental as are negative effects.**

It has been argued that effects can be better planned:

> ...while many of the human consequences of this technology are complex and subtle, they are largely predictable, given an appropriate analytical effort.
>
> ...it is possible to specify the changes in systems methodology required to shape the systems toward organizational objectives. Practical know-how here is still modest, but we know more today than we are putting to use.***

The flexibility that is characteristic of information technology can allow automation in the office to be less deterministic and to permit more choices. The dropping costs of computers make it possible to consider more technical options, and the new technology is less hardware dependent and more software intensive, and so is more flexible. The same information task, therefore, can be accomplished by a variety of technical configurations, each with a different set of organizational and human implications.

* Greenberg, M., (1981), p.12.

** Walton, R. (1981).

*** Walton, R. (1981).

Rather than allow organizational aspects to occur haphazardly, the introduction of information technology can be viewed as an opportunity for change to improve the structure of work.

In sum, the introduction of new information technology into the office can be expected to have profound impacts within the organization -- yet these effects (positive and negative) have been largely accidental in the past, as those planning technical systems gave little attention to them. For a number of reasons (to avert the negative experiences that have frequently occurred; to improve productivity among white collar workers, where "productivity" is a complex matter; to respond to more demanding employee expectations about the nature of work) the recognition has grown that information systems are not merely technical but rather that the technology plus organizational and also human needs must be jointly considered.

Exhibit 2-3 indicates the social impacts of office automation which arise at the organizational level. They are grouped under five headings:

A. Management and Organizational Control
B. Organizational Structure
C. Hours and Place of Work
D. Career Pathing
E. Work Design

A. Management and Organizational Control

The implications of office automation concerning organizational control are twofold. First, new systems of communication and information retrieval may affect the authority structures within the organization, and alter the roles played by management. Secondly, computerized measurement systems can become a new means to control performance among employees at all levels.

EXHIBIT 2-3
ISSUES IDENTIFIED AT THE ORGANIZATIONAL LEVEL

B. Organizational Structure
   - i. Removal of levels
   - ii. Two-tiered effect
   - iii. More contract work
   - iv. Changed importance of different units

C. Changed Hours and Place of Work
   - i. Shift work
   - ii. Off-hours work
   - iii. Cottage industry work
   - iv. Satellite work places
   - v. Work from the home

D. Career Pathing
   - i. Managerial/professional employees
   - ii. Clerical workers

E. Work Design

It can broadly be said that the technology holds potential for both increased decentralization of organizational control (through simultaneous access to information, electronic communications, decentralized workplaces, etc.), and also for increased centralization through computerized monitoring of the use of the electronic tools in the office.

i. Changed Authority Structures

The tenet that "information is power" implies that significant changes can be expected in an organization if the flow and accessibility of information are altered.

For example, it has been suggested that the exclusive purveyance of senior management over the whole enterprise may be challenged.* More information will be available and overviews will be less costly. Also, new and more informal information channels such as electronic mail may bypass the traditional filtering of information upwards and downwards through a hierarchy where managers exercise control at all levels. These and other features of the technology may significantly change organizational control and management. Formal authority structures may be altered, particularly at the supervisory or middle level of management and new informal communications patterns may change the processes of decision-making, task assignment, and career advancement.

Such changes may be disturbing to those who have spent years working their way up in a hierarchy that now appears undermined. Alternatively, new styles of management may develop that offer new productivity gains to the organization, and represent a preferred type of management to some individuals.

*Pava (1981)

ii. New Forms of Management

Several new forms of management and corporate structure have gained attention in the last decade. For example, matrix organization is a complex system based upon dual rather than single chains of command. Managers must adapt to new patterns of lateral decision-making. Also, with the success of Japanese business, attention has focused upon the Japanese system of corporate organization, found in the Zaibatsu or industrial group and the Sogasosha, or trading company. The corporate structure is characterized by co-operation, trust and loyalty:

> Lifetime employment encourages loyalty. Training is rarely specialized, most often general. Lines of communication are open both vertically and horizontally, with status no barrier. White and blue collar mingle and communicate. So strong are the ties that the trading companies are basically just networks of agents, each acting independently but with the knowledge that the system is immediately responsive to their needs. And the system is little more than a computer-satellite world network, where each may communicate with any or all other agents put together a deal.*

The feasibility of adapting such models in the North American corporate world is a debatable point. Nonetheless these two examples illustrate alternatives to North American traditions, and it may be found that with new information technologies these or other new forms of management are more appropriate than traditional hierarchies. It has also been suggested that more consensual approaches to decision making may be taken at senior levels, given an increased availability of information and of fast and reliable communications channels.

* Russell, R. (1981) p.9

In sum, new styles of management may in effect require an adaptation to a changed "organizational culture" with significantly different values, goals and skill requirements.

It is at the supervisory or middle level of management that office automation is first expected to force a rethinking of managerial roles.

iii. Changed Role of Middle-level Management

The role of the supervisory or middle level manager appears a likely candidate for change through office automation. In comparison, the role of senior executives (i.e. to define and realize the "mission" of the organization and deal with the external environment) and the role of workers (i.e. to focus upon and complete primary tasks) remain relatively intact.*

Primary functions of the middle level manager include: translating from the "mission" to the task level; training workers; supplying senior management with information and supervising and giving direction.

Changes a supervisor can expect include the following:

(a) less traditional supervision may be required, either because employees become more self-supervising or because computerized monitoring of performance is increased;

(b) with facilitated communications, less time may be spent packaging information for superiors, or re-interpreting senior management's directives to workers;

* The observations here are from an unpublished paper provided by Mary Baetz, an organizational consultant working with Fromkin Van Horne. The terminology is frequently found in organizational analyses.

(c) the manager will be less familiar with the new jobs using electronic tools that are now under higher supervision.

Rather than act as an interpreter between senior and worker levels, the supervisor may become a "facilitator" for communication between these levels. Less emphasis may reside with supervision, while more emphasis is placed upon "human skills" -- training, job design, conflict management, team building, and career pathing including assistance for displaced workers. In addition, the supervisor will be required to understand technology, to keep out unneeded technology, and to introduce new systems effectively. A high degree of familiarity with computer technology will become important.

It appears possible that while the need for the traditional functions of the middle level manager may be reduced, a valuable new role may emerge. On the negative side, however, are the problems of definition and adjustment to a new role, plus the possibility that in many instances fewer supervisors will be required and opportunities for employment and advancement will be reduced. This last possibility is discussed further in Section B which follows.

iv. The Use of Measurement Systems

One of the characteristics of computerized office equipment is the ease with which performance can be monitored. It becomes possible for the organization to collect an unprecedented amount of data on employee activity, yielding information about productivity, use of time, and other performance criteria. At all levels, employees may experience a new degree of surveillance that may cause stress or appear as an invasion of human privacy.

The opportunity to record employees' activities is extended by the new technologies in terms of detail, time, and place. For example, a manager can check if a subordinate has logged on over the weekend from a home terminal. Pressure may arise, from both superiors and peers to do extra work at home during off-hours. Clerical workers face the possibility of quotas, closely monitored productivity and closely supervised piecemeal work from the home.

A further aspect of surveillance is that a supervisor may display an employee's computer screen at his or her own terminal, and thus view employee performance directly.

The points of impact that have been described in this section could translate into either positive or negative effects depending upon the choices made within individual organizations. It is possible, however, that results will tend to fall unevenly between the managerial/professional and clerical groups in the office. That is, managers and professionals may enjoy certain benefits from changed control in the organization (a centralized or more consensual approach to decision making, for example, or a less hierarchial style of management); the clerical level, however, experiences an intensified, centralized control through automated monitoring.

B. Organizational Structures

New information technology will affect organizational structure in complex ways. Jobs may be redesigned at the time of implementation, when the process of computerization entails at least some degree of organizational rethinking. (In one case, 90% of the productivity gains due to word processing were attributed to the re-organization of clerical jobs rather than to the new technology itself).* Certain jobs may be reduced in a direct manner by the technology. Also, over time and less directly, the new technology can become:

> ...a driving force to an eventual re-structuring of the organization. As the various tools are integrated and the organization uses information in innovative ways, new methods of working and relating will emerge.....In order to optimize the use of the organization's resources, there will be a push to restructure.**

Several likely structural effects and their social impacts are considered below.

i. Removal of Levels

One structural result of office automation that seems possible to a number of observers is that of a removal of levels within the organizational hierarchy. As noted above, positions at middle management levels may particularly be reduced, providing less opportunity for advancement among managerial and professional employees.

* Working Women, Race Against Time (1980), p.10.

** Baetz, Mary (paper in preparation, 1982).

ii. Two-tiered Effect

As desktop terminals connect managers and professionals to each other and to shared information resources, clerical workers who formerly acted as intermediaries may increasingly be bypassed. The office may operate as two "tiers" (managerial/professional versus clerical) with reduced interaction between the two levels. The possibility of a more pronounced division between these occupational groups in the office has been discussed elsewhere.*

iii. More Contract Work

It is possible that the use of non-traditional labour may be increased with new information technology. This could include word processing and other clerical tasks done from the home as piecemeal "cottage industry", or the acquisition of specialized services from information sector firms on a contract basis.

Several concerns about social impacts arise with contract work. On the one hand, the freedom in determining place and time of work and the direct financial gains from such activities can be highly positive effects. The potential social problems include physical isolation, lack of worker protection and benefits, isolation from both the formal and informal opportunities for advancement in a corporate structure, and effect on family life if work intrudes in the home.

Again there is a possibility of a dual effect -- i.e. the more negative effects of contract work may particularly be experienced at the clerical level rather than among the managerial/professional groups.

* See sections on "Dual Labour Market", p.39.

iv. Changed Importance of Units

Along with changes in hierarchical structures, changes in the lateral relations between units within an organization may occur. The importance of some divisions may be decreased as jobs within them are automated; on the other hand, other units, especially those engaged in technically sophisticated activities or more demanding knowledge-based tasks, may swell in size and prestige. From the employee viewpoint, the desirability and status in being associated with a particular unit may shift, following a pattern of rising prestige among the more knowledge-based units.

C. Changed Hours and Place of Work

In the automated office, information resources that can be accessed electronically from remote locations are constantly available, and can be used independent of the presence of others in the workplace. Thus office automation extends both the hours and the place of work.

A number of social impacts of the extended workplace are considered below. It should also be noted that frequently work outside of the traditional office setting may take place on a contract basis.* Thus the impacts noted below will often be combined with the impacts of contract work.

i. Shift Work

Once capital outlay has been made, it may make economic sense within an organization to maximize the use of equipment. Shift work may be practical, particularly at the clerical level.

* Social implications of contract work were considered above: flexibility in time and place of work stand out as benefits, while isolation and lack of worker protection and benefits stand out as potential negative effects.

Large banks today often establish operation centres where employees enter data all night. Disrupted sleep patterns and disruptions in family and social life can result.

ii. Off-hours Work

While shift work is unlikely among managers and professional workers, this class of employee may experience pressure to do work during non-office hours through portable terminals used either from the home or during travel. The simple fact that the work environment can be accessed instantly may create a kind of compulsion to work off-hours. Also, pressure (overt or subtle) may arise from either superiors or peer groups to log-on during off-hours. Discounted telecommunications rates and other incentives to access information resources during non-peak hours may also encourage employees to do work at non-traditional times.

Disruption of sleep patterns, disruption of family and social life and compulsive working can become problematic.

iii. Cottage Industry Work

Particularly at the clerical level, there is concern that information processing tasks may be done on a piecemeal basis from the home, and that a pool of unorganized labour could thus be exploited. The negative features noted earlier regarding contract work (physical isolation, isolation from channels for advancement, lack of protection and benefits, intrusion of work into family life) may be felt, and may be combined with the forced pacing and monitoring that can occur with performance measurement systems detailed enough to count keystrokes per minute.

In general the possibility of a new trend in women working from the home has caused contrasting responses. On the one hand, many women will view work from the home as a good chance to earn money while remaining at home with a child. Women at clerical levels in particular, whose salaries limit the use of babysitters or child care services, may adopt this attitude. Others fear that such work will confine women to isolation in the home, and will reaffirm the role of women as the person in the home -- the childminder and housekeeper.

This type of work also could lead to the growth of a hidden economy, where earnings are unreported and monitoring for tax and benefits is very difficult.

iv. Satellite Workplaces

With "satellite workplaces", a large firm establishes small offices in decentralized locations to allow employees to work near their homes without commuting to a downtown core.

The benefits of decentralized workplaces which are usually cited are "telecommunications/transportation tradeoffs", i.e. less wasted time traveling, plus energy savings. These can be defined as inter-city business travel and intra-city journey to work travel. Effects of automation are likely to be felt in both sectors. The potential negative effects include:

- Physical isolation from a more dynamic centre of business and social activity. The small office may be a much less stimulating environment than the central office.

- Isolation from opportunity to advance within an organization. Even if formal structures were to require that satellite workers be considered for advancement, these workers are less

likely to have been observed by decision makers. Although the informal opportunities, contacts, grapevines, etc. that arise within the office structure through proximity have not been well examinined, these are likely to be sorely missed by an employee if they are lost through relocation.

A question related to the location of the workplace is that of reduced business travel. Various forms of teleconferencing have been advanced as a benefit of office automation, as a means of reducing travel costs especially for inter-city travel. Studies have found, however, that there is considerable personal resistance to the substitution of electronics for such travel. First, people like to travel -- to a certain degree. Surveys have indicated that most people would not wish to reduce business travel, but that those who travel very frequently would prefer to reduce the number of their trips. Secondly, some face-to-face personal contact is important, and teleconferencing is more acceptable among people who have already met.* The extent to which an organization can substitute teleconferencing for travel will be affected by these personal preferences for variety through travel and for face-to-face meetings.

With both satellite work centres and inter-city teleconferencing, trust, collegial and personal connections and complementary objectives become more important when work is to be accomplished without personal proximity.**

* Telecommunications Policy (March 1982).

** Pava (1982).

v. Work from the Home

Work from the home can take many forms. A salaried manager/professional employee may occasionally work at home to gain a few uninterrupted hours; a professional may do contract work from the home; clerical staff may engage in work on a "cottage industry" basis; a manager or professional may work extra hours evenings and weekends through a portable terminal or microcomputer. The social implications of work from the home in such cases will differ considerably. Depending on the individual instance, a number of impacts previously associated here with "Contract Work", "Off-hours Work", "Satellite Workplace" and "Cottage Industry Work" may be relevant.

D. Career Pathing

The changes in organizational structure which occur with office automation will in turn affect career pathing -- i.e. the channels of advancement available to an individual within the organization.

i. Managerial/Professional Employees

Earlier sections on organizational structure pointed out that managers and professionals, whose career expectations are often high, may face fewer opportunities for advancement within the organization. The ranks of middle and low-levels of management may contract, reducing the positions that could serve as steps up a corporate ladder.

It is possible (given the growth of small businesses), that opportunity for advancement among "knowledgeable workers" may frequently be found in a move out of an existing corporate structure to a newer and smaller organization.

ii. Clerical Employees

Historically, at the clerical level little opportunity for advancement has been experienced. It is in fact because clerical workers have so few career opportunities open to them that there is concern about reductions in clerical jobs.

Career options for secretaries in the future will revolve around:

1) learning a computer-related skill;

2) improving administrative skills and assuming more responsibility;

3) exploring the feasibility of training in a totally different kind of career.*

On the positive side, two points about the effect of automation on clerical workers are put forward. It has been suggested that the re-organization of clerical work into new units (word processing units, etc.) may create new supervisory positions. Secondly, the shift from secretary to "administrative assistant" is often discussed in the context of office automation. It is argued that, as typing and other simple forms of information processing are automated, the secretary could devote her time to handling many administrative and fact-finding tasks which consume the time of the higher-salaried managerial/professional worker.

* Humphreys, E. (1981), p.13.

The occupational segregation of the clerical worker* limits opportunity severely, and there is little organizational commitment to training for advancement at the secretarial level.

E. Work Design

Work design is discussed here in terms of two polarized approaches: (1) the automation of entire processes, and (2) automation as the use of electronic tools at the worker's discretion to accomplish tasks at the workplace.

When automation has been introduced into organizations, it typically follows a method of work analysis based on time and motion studies and known as "rationalization", "scientific management", or "Taylorism". Work is broken down into identifiable and measurable units which can be isolated from an ongoing process and automated. Assembly line production in an auto factory illustrates this form of organization of work.

Computerized word processing has followed this model. While productivity gains can be easily measured, the portions of work that remain unautomated have often been associated with de-skilling, lack of variety, and other concerns about the quality of working life.** Employee morale may drop, leading to a high turnover, absenteeism, etc. Errors are made by workers who view the use of mental acuity as inappropriate to their jobs. In the case of word processing frustration can result among the "knowledge workers" who find that their documents are being handled mechanically.

* Discussed in Chapter One.

** See Section 2.4.3.

In the office, the Tayloristic approach could continue to identify and isolate specialized functions for automation -- beginning at the secretarial level where information handling is more routine, but working up also into the ranks of lower and middle level information workers who have a considerable component of routine information-handling in their jobs.

Rather than analyze work only for the purpose of extracting repetitive tasks for automation, it has been suggested that work be organized instead as coherent tasks to be accomplished by groups responsible for the successful outcome of the work as a whole. Exhibit 2-2 illustrates both the clustering of tasks and the work group structure. Exhibit 2-3 further illustrates the idea of re-organization following a work group model. In general:

> ...The conventional system combines a complex structure with simple work role; the (work group) systems combine a simple formal structure with complex work roles.*

Regarding Exhibit 2-3:

> ...Whereas the former organization has been maintained in a steady state only by the constant and arduous efforts of management, the new one proved to be inherently stable and self-correcting, and consequently freed management to give more time to their primary task(s)...**

* Van Beinum, Hans, (August 1981).

** Ibid.

EXHIBIT 2-4

ILLUSTRATION OF TASK COHERENCE AND WORK GROUP STRUCTURE

Figure 1, the workflow before introduction of the experimental changes

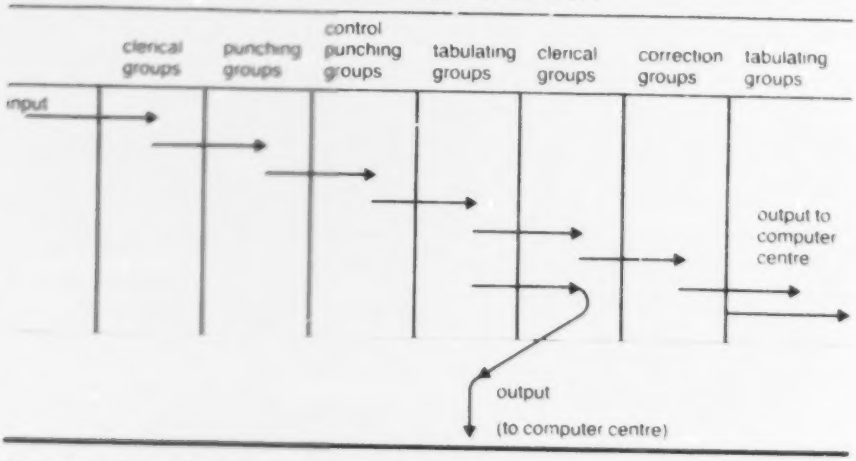
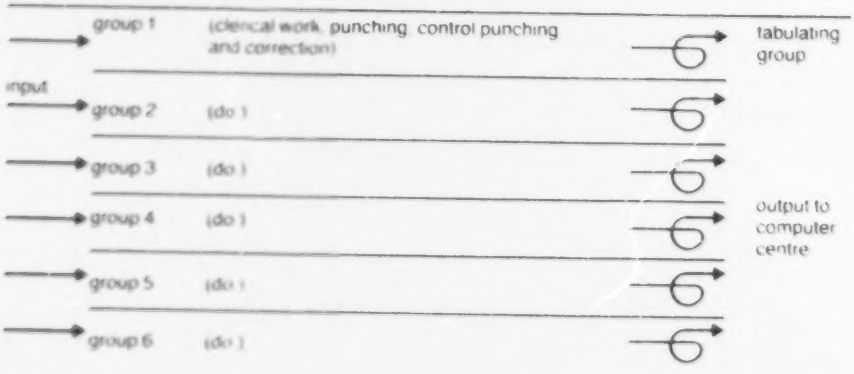


Figure 2, workflow after introduction of the experimental changes

A workflow when corrections are needed
B workflow when no corrections are needed
A continuous line between groups indicates spatial separation

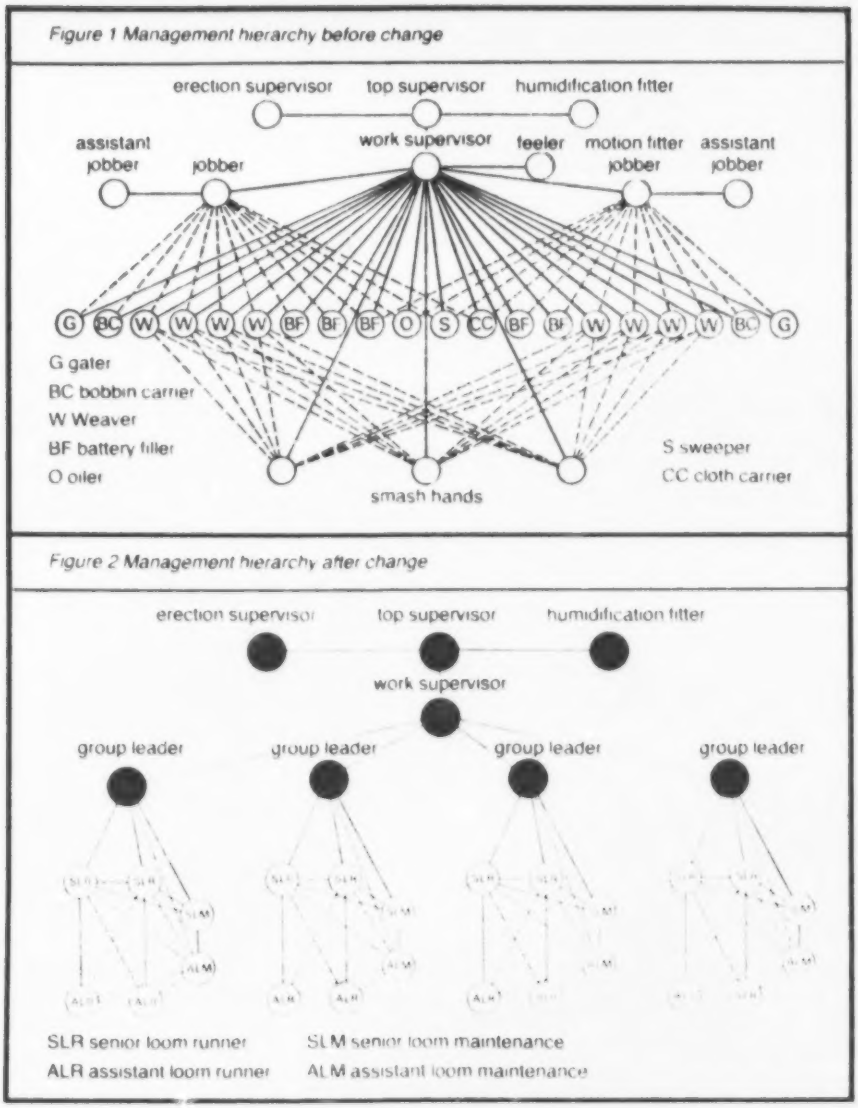


Postal and cheque processing example.

Source: Van Beinum, Hans, QWL Focus, Aug. 1981.

EXHIBIT 2-5

ILLUSTRATION OF WORK GROUP STRUCTURE



Textile Mill example.

Source: Van Beinum, Hans, QWL Focus, Aug. 1981.

The choice between these two approaches to automation has been put as follows:

> ...to use the new technologies as extensions of human operators who have extended responsiblity and discretion, or to use those humans as mere extensions of the technology.*

In some ways, the vocabulary used in connection with office automation for knowledge workers resembles the approach taken by sociotechnologists who emphasize that the computer should be a multifunctional tool used when needed by the individual in the course of his or her work. For the clerical worker, however, the way in which word processing has proceeded represents the contrasting approach, designing of jobs that consist of a single, partially automated task. The Quality of Working Life and sociotechnical approaches which emphasize the positive results of task design for both organizations and individuals will be further discussed in Chapter 5. A further positive aspect to work design is that when a work group perspective is taken, new roles can perhaps be considered for clerical workers in new information-based tasks that may arise through office technologies.

2.4 Individual Level

The social effects experienced by individuals in the workplace are frequently referred to as "quality of working life" (qwl) issues. This term will be used here also. A distinction should be made, however, between "qwl" used as a term for a cluster of issues, and QWL (Quality of Working Life) which refers to a specific applied approach to the organization of work, described in Chapter 5.

* Taylor (1981).

There are a considerable number of qwl issues, which are grouped here into five categories:

A. Control
B. Nature of the Work
C. Job Meaningfulness
D. Career Development
E. Dependency on Technology
F. Social Needs

A. Control

There are a variety of ways in which new office technology may affect the sense of control experienced by an employee. While the new technology may well be liberating (relieving the worker of mundane tasks and making information resources and communications networks instantly accessible), it may also be the case that organizational control over an individual's activities has increased through computerization.

Most of the potential negative impacts of increased control stem from the ability of the technology to monitor performance, or to manage a task itself so that the activities of the individual seem determined by the machine. The efficiency of the technology also increases the accountability of the employee to complete tasks promptly and correctly, with little opportunity to make excuses.

i. Monitoring

An employee's performance can be monitored electronically in a number of ways. Records can be kept of time logged on, number of interactions, number of keystrokes per minute, etc. An employee's work at the terminal can also be directly observed by a superior who duplicates the employee's display screen at his or her own work-station.

The employee, meanwhile, may experience stress about performance, and a demeaning sense that his or her capacity for responsible behaviour is not being respected. Employees may particularly perceive direct scrutiny by superiors as an invasion of privacy.

ii. Pacing

Pacing is a form of monitoring performance suitable to certain tasks that can be readily counted. Such tasks occur particularly at the clerical level. In an insurance firm, for instance, time standards can set the pace for most clerical jobs; coding an A-type claim is alloted four minutes, a B-type claim 5 minutes, etc. Computer terminals used by data entry operators record keystrokes per minute and lines processed per day. Standards for the rapid completion of work result, as do quota systems in some cases.

The potential negative social effects of such pacing include: stress due to machine-regulated control of the pace of work; competition; and resentment against rapid workers (who may then be inclined to slow down, to conform). There is also a tendency for special work efforts (rush work, for example) to elevate the standards that are normally expected. Workers resent this tendency, and may in fact resist making special work efforts when they are required.

Though such conditions are more prominent at the clerical level, it can be imagined that many white collar jobs which primarily handle routine paperwork could be liable to such pacing effects.

iii. Autonomy: Decision making and Responsibility

The concept of autonomous work implies that the individuals (or groups) performing a job can plan, regulate and control aspects of their work. While management specifies desired outcomes, organizational maintenance requirements, critical interventions, etc., individuals or groups "accept responsibility for the cycle of activities required to complete the product or service."* This could include establishing the rate of output, designing the structure of jobs, evaluating performance, etc.

While new information technology could be applied to increase autonomy, some fear that decision making and responsibility may be reduced for the individual if the computer takes on the organization and control of a task.

iv. Accountability

The potential of new information technology to be used for monitoring has been noted above. One result of such monitoring could be the increased employee responsibility for the efficient use of his or her time. Already, clerical workers have found their freedom to move about the office limited both due to monitoring and to the efficiency of the technology -- there is little reason to move about the office if all one's resources can be accessed at the workstation.

* Labour Canada, The Labour Gazette, (1978), p.32.

In addition, and perhaps of more significance to managerial/professional workers, is that with the efficiency of the technology, an often-used set of excuses for the failure to complete a task will simply no longer apply -- slow mail, missed messages, missing documents, etc.

While the employee's responsibility to perform well may be indisputable, a number of uncomfortable questions may arise (especially concerning white collar workers) about how employees actually spend their time and what standards of performance are ultimately feasible.

v. Worker Participation

Most points noted in this section have concerned the exercise of control by the organization upon the employee. It is also possible for employees to engage in control functions such as decision making and job design within the organization. "Industrial democracy", as such worker participation is termed, is much more an issue in Europe than in North America. Nonetheless, it has become more common for workers to participate in consultative processes concerning the introduction of new technology, job redesign, etc. Employee participation is an essential part of job redesign in QWL and sociotechnology approaches, whose proponents argue that such participation is required for successful projects.

B. Nature of the Work

The positive influences of automation on the nature of work in the office centre around relief from mundane tasks, speed, (in communication, information access, etc.) and convenience.

Among negative effects, increased stress, de-skilling, and monotony have received most attention. Job meaningfulness is also an important factor, and is discussed separately in Section C.

i. Increased Stress

An increase in job stress may result from a number of potential impacts noted earlier, i.e. from monitoring, pacing, increased accountability, etc. Other reasons for increased stress levels can be readily imagined. The speed and efficiency of the new technology may increase workloads and raise performance expectations. The margin of allowable error may be reduced through computers, given their precision.

ii. De-skilling

Although in many cases the new technology can be expected to increase skills requirements, attention has also been drawn to potential de-skilling due to the new technology.

As the computer takes on a certain degree of responsibility for a task, the functions that remain for the individual to fulfill may utilize fewer skills. A decrease in the variety, challenge, and satisfaction of the work may take place.

De-skilling may especially affect clerical work and lower-level white collar information jobs -- while skills requirements rise for many managers and professionals performing more knowledge-based work. One should remember to ask, however, whether a low-skilled job in an automated setting is in fact a result of de-skilling. It could be that low skills levels may have characterized the work in question before automation occurred.

iii. Job Interest/Monotony

There is some irony in the fact that while emphasis is placed on the potential of the new technology to reduce monotonous tasks and to free time for more significant work, concerns are also expressed about an increased monotony in jobs as a result of automation.

Monotonous work may in particular occur in jobs which are largely automated, as discussed in "de-skilling", above. The computer is responsible for most of a task, leaving a set of loose ends however which call for human intervention. An uncomfortable sense of "working for the machine" is often experienced in such cases.*

*Taylor, (1981), gives details and examples at some length.

C. Job Meaningfulness

There is a frequently expressed concern (especially at the clerical levels) that computerization in the office will follow the model of factory automation, whereby individuals perform small bits of a process managed and primarily accomplished by a machine. Each individual would be assigned a single task, with little discretion or responsibility as one task would be largely automated. An emphasis is placed on work design* to maximize the positive aspects of job roles.

Other points regarding job meaningfulness include the provision of some form of feedback about the results of work efforts -- from a superior, peers, a client group, etc.

D. Career Development

A set of issues grouped here under "career development" relate to both an immediate experience that one's work is adequate as an occupation (i.e. it provides appropriate rewards), and the sense that one's work may lead to some desirable future. These issues include:

i. Appropriate pay and benefits
ii. Job security
iii. Opportunity to learn and develop new skills
iv. Opportunity to advance

* See 2.3.

E. Dependency

The use of automated equipment in the office may in some instances lead to a psychological dependency by workers on the machine. At the clerical worker level this may be a result, to some extent, of a de-skilling effect whereby individuals are trained as operators. Their jobs are dependent on particular models and types. As new enhancements and model changes occur they may feel vulnerable and threatened if training programs and upgrading of their skills is not readily available.

At the managerial level, automated workstations are expected to enhance decision making through better and quicker access to key pieces of information. Individuals may utilize such services as on-line data bases and on-line searches. There is some danger that individuals may become restricted to those sources most readily accessible in machine readable form and those within the computer locus of access. Restrictions may be placed on searches and editorial control, and censorship may be exercised to limit the range and type of information available.

In some cases, dependency may be manifest in the restructuring of work times in order to take account of low use periods and low peak loads on a computer system. In these times, processing is faster, queuing time less, and the probability of network failure much reduced. The individual manager/knowledge worker may, therefore, alter the composition of work time as a result of this dependency on technology. Thus, while automation offers increased flexibility in terms of access, a significant amount of informal restructuring to make work time more efficient could result. These shifts could cause significant alterations in the individual's time/space/activity allocations.

F. Social Needs

Social needs in an office environment are seldom analyzed, but they are important for both psychological well being and job effectiveness. Among knowledge workers, the value of social networks may be particularly important. Associates are a primary means of keeping informed and a network of contacts may be critical in performing a knowledge-based job effectively.

i. Communications Networks

The positive aspects of new office technology regarding social needs include the formation of communications networks among communities of interest, and the formation of more intense work groups through computer conferencing. Through communications, the knowledge worker is connected to a peer group irrespective of physical proximity.

ii. Balance Between Work and Home

A second positive aspect of the new technology for social needs is the potential to help balance the demands of work and home, by allowing a parent to work while remaining at home with a child for example. On the negative side, work done from the home may intrude into family life. Several further effects of work from the home were discussed in Section 2.2.

iii. Provision of a Group Structure

The provision of group social support for an employee could be either increased or decreased by the new technology, depending in large part on how work is organized and how jobs are designed. The individual may find himself or herself interacting largely with a

computer display screen. Alternatively, the design of work to place employees within a group structure may be emphasized.

iv. Privacy

Along with a feeling that they are connected to others, individuals require a sense that they can retain personal privacy. New office technology may reduce privacy in various ways. Computerized storage of company records can cause anxiety that others will view files containing personal information. Computerized workfiles could also be accessed and scrutinized by others who are either authorized or unauthorized to do so. An individual may feel that observation of the work process, or examination of one's work output, before one feels it is completed, is an invasion of privacy. Office automation may also reduce physical privacy, depending on the configurations and floor plans that are adopted.

Section 2.6 summarizes those issues which appear most important out of the set of impacts examined here on macro, organizational and individual levels. The next section deals briefly with the subject of training, a central topic in discussions of the impact of new technologies.

2.5 Training

The importance of training (including retraining) emerges repeatedly in an examination of the social impacts of automation. The expectation that occupational displacement will occur is almost universal, and retraining is specified as the counter measure to unemployment for those in occupations where jobs are reduced.

It is not within the scope of this project to explore the subject of training in any depth. Training programs are a complex mixed effort involving the federal government, provincial governments and private firms. The Canada Employment and Immigration Commission alone budgeted for a substantial $659.4 M for three major training programs in 1981-82: the Canada Manpower Training Program

(federally financed but operative through provincial colleges and training centres); the Canada Manpower Industry Training Program, which aids employers in training; and Critical Trades Skills Training, which also gives aid to employers.

Nonetheless, inadequacies in training programs in meeting industry needs have been emphasized by recent government investigations. The Task Force on Work Opportunities for the 80s found skill shortages side by side with unacceptable rates of unemployment, and asserted also that the programs of federal Employment and Immigration "had not had much effect on these manpower inbalances".* Problems included different jurisdictional responsibilities between federal and provincial governments, and a plethora of programs which became confusing for both clients and staff at Canada Employment Centres.** A Task Force on Labour Market Development in the 1980s noted in particular that Employment and Immigration training programs "have devoted few resources to middle level skill training for technician/technology type occupations" though an increased demand in the 1980s is expected for this type of training.***

Subsequent to these reports, the Employment and Immigration Minister outlined federal proposals for "a new National Training Program, designed to overcome skill shortages, accelerate economic growth and development and facilitate industrial adjustment".**** These proposals include: the designation of national occupations for special funding and acceleration of training, a shift of resources towards training for skills in demand and for workers affected by technological change; and an emphasis on equal opportunity for women and other client groups with special needs".*****

* Parliamentary Task Force on Employment Opportunities for the 80s (1981), p.57.

** Ibid, Chapter 3, "What Went Wrong?".

*** Employment and Immigration Canada (July 1981), p.176.

**** Employment and Immigration Canada, Press Release, January 6, 1982.

***** Ibid.

The need for improvement was stressed:

> It is clear that, despite its accomplishments, the Canadian adult occupational training system has for some years been unable effectively to meet the challenge of providing adequate numbers of Canadians with training in middle and high level skills. At the same time, it is equally clear that too much of the training still carried on responds to the needs of the past rather than to the demands of the future: too much of current industrial and institutional training in Canada does not lead to related employment, or higher skills, or better jobs, but to continued unemployment and frustration.*

One component of the federal plan is a system to determine future employment skill needs. A computerized model (Canada Occupational Projection System) is being developed with the federal government.

Some determination of where future opportunities will lie is essential for fruitful training, and this has evidently been a problem in the past. Chapter One of this report noted that both the job displacements and the new opportunities anticipated in the service sector relate to what can be thought of as "information sector" activities. Furthermore, government policy (at both federal and provincial levels) supporting the microelectronics and telecommunications industries are evidently based on a belief that these are promising growth areas. Yet such information sector industries, and the information sector occupations that are required within all industries as well, are poorly reflected in the policy documents noted above. Rather, the vocabularly of analysis reflects the past sectoral distinctions between primary, secondary and service industries. While most of these policy documents acknowledge that there is a poor understanding of where opportunites will lie, unless the terms of analysis are changed to capture new growth areas, projections for the future will not be adequate.

* "Federal Occupational Skill Development Policy for the 1980s: A National Training Program", a paper presented to the federal-provincial conference on skills training for the 1980s, by the Honourable Lloyd Axworthy, Minister of Employment and Immigration, Ottawa, January 4, 1982, p.3.

Information sector opportunities in particular need to be assessed. If, under examination, opportunities here appear to be low, this has implications for governmental industrial policy; if opportunities are high, training must respond to identified needs. There have been vocal complaints for several years, for instance, about shortages of computer specialists.

In relation to the social impacts of office automation, the critical training (and retraining) questions are as follows:

1. Where do opportunities lie, so that individuals can be usefully trained?

2. How can outreach counselling be accomplished to draw those who need it into training programs? It has been suggested that, particularly for clerical workers, advertising, films and other means of communications to reach large numbers of people may be required.

3. Job loss among clerical workers appears most problematic. These jobs are most vulnerable to automation, yet occupational segregation is high among clerical workers who have little opportunity to advance or to change occupations. How can affirmative action be applied at the clerical level?

4. There are also questions regarding increased means of support for training programs. Tax incentives and levy-grant systems, for example, have been proposed.* Grants, subsidies and other means of support for training have also been proposed.

* In a levy-grant system employers are assessed a levy based on skilled trade needs and the costs of training; they receive a grant only when they fulfill standards and train a certain share of employees. Tax incentives could function as a payroll tax (perhaps 0.5%). Money spent on training would be credited against this tax, and if in excess of the calculated tax figure, would be treated as a deductible business expense.

5. Finally, there are questions about means of support for individuals while training (living allowances, child care, travel, scholarships, etc., especially lower-salaried workers).

In sum, training is a central component of the occupational bridging that is required under the conditions of displacement that automation is likely to create. The identification of new and more opportune occupations, outreach counselling and support are especially important among clerical workers.

2.6 Summary

This chapter has identified a range of potential social impacts of office automation at three levels: the Macro or societal level; the Organizational Level and the Individual Level. Issues at the organizational and individual levels are closely linked as organizational changes are directly experienced as impacts by employees.

From this list of social impacts, the most demanding issues appear to be as follows:

1. Whether a net job loss or gain results from automation, occupational displacements are widely anticipated. The most pressing problem, in terms of probability of occurrence and in terms of the concern it is causing, is that occupational shifts will have a particular impact on women concentrated in clerical positions. These jobs of workers are most vulnerable to office automation and clerical workers are most limited in occupational mobility. Furthermore, the skills gap that separates them from the managers and professionals in the office is likely to be widened as an effect of automation. New job opportunities appear to lie in highly skilled knowledge-based jobs and a dual labour market effect, where clercial workers find few opportunities, is feared. Thus the problem of occupational mobility for clerical workers appears critical.

At the organizational and individual levels considered together, three points dominate:

1. Just as office automation may widen the gap in a dual labour market in terms of skills requirements and opportunity for employment, it is possible that a disproportionate weight of the negative impacts of automation on worklife may be felt by clerical as opposed to managerial and professional staff. De-skilling, monitoring and pacing, reduced job meaningfulness, isolated work from the home and other effects noted in Section 2.3 may particularly be experienced at the clerical level.

2. At the managerial and professional levels, office automation equipment is more likely to be presented as a "multifunctional tool". The benefits of the technology on working life (relief from mundane work, speed, convenience, specialized applications for professional support, etc.) are aimed at this level, and such negative effects as de-skilling and reduced job meaningfulness are less probable. Problems at the clerical level appear more immediate and more dramatic. There are, nonetheless, a cluster of issues which may impact the manager or professional in a negative way.

   a) Job Stress may be intensified due to a number of factors -- increased performance requirements, accountability, adjustment to changed roles, etc. Instant electronic access to the workplace from the home may induce a compulsion to work off-hours.

   b) Standard Career Advancement paths within an organization may be diminished, new forms of management may emerge, and flexibility and job mobility may be the keywords of success rather than steady performance and advancement through a stable organizational structure. Many more traditionally minded employees may find this changed context difficult.

c) Automation may begin to have significant replacement effects on lower level white collar information jobs that have a large component of routine paper handling. Employees in such jobs may begin to experience job reductions, reduced job variety and other negative effects associated with clerical workers.

3. Work Design appears as a critical issue. Many negative effects at the organizational/individual levels are associated with a particular approach to automation and to the organization of work: the tendency to isolate a process for automation, leaving bits and pieces of work for individuals who work all day at single tasks.

This method of automation has not been espoused regarding "knowledge workers", for whom, in contrast, office automation is presented as a "multifunctional tool".

To avert negative job effects, approaches such as Quality of Working Life and sociotechnology have emphasized:

a) the organization of work groups with shared responsibility in the outcome of work;
b) the use of the computer as a tool to accomplish tasks (rather than the use of individuals to fulfill parts of tasks which the computer cannot perform).

The last point pertains to all workers in the office, and not only "knowledge workers".

Within the framework of these approaches, the suggestion has been made that job redesign accompany automation in terms of a work group system, and ones that include both clerical and knowledge workers, in which clerical workers, for example, take on useful

assistance roles in which they too use office equipment as multi functional tools. A general introduction to QWL and sociotechnical approaches is given in Chapter Five.

A rethinking of the roles of clerical workers and managerial/professional workers is required that views both levels as part of the same work system. Particularly, ways in which clerical workers can take on new, useful tasks to support the work of a group of managers and professionals through changed work organization should be explored. Such redesign may avert certain negative impacts on worklife and alleviate the job reductions likely if clerical roles are simply broken down into functions that can be automated or bypassed. Many managers and professionals would agree that secretaries perform other work than typing, filing, correspondence, etc.; yet if no coherent attempt is made to define a new role for the secretary, these workers will lose employment and find few opportunities as automation increases.

CHAPTER THREE TWO MAJOR CONSTITUENCIES

Two main groups in society directly concerned with the impact of office automation are discussed in this chapter. First, women's organizations have a well-developed awareness of the disquieting implications of office automation from a women's perspective. They are actively considering office automation issues at this time. Second, organized labour is concerned with the effect of automation in general and has identified office automation as a risk to employment, especially among female workers (though most workers affected are not unionized). The role of unions regarding technological change in general will be briefly discussed.

3.1 Women's Organizations and the Women's Perspective

In the past ten to fifteen years, the women's movement that spread through North America produced a new set of organizations concerned with the position of women in society. The place of women in the work force, always an important issue, was emphasized as women during those years entered occupations where their participation had formerly been more limited, or advanced in increasing numbers to management levels.

These organizations provide an infrastructure to deal with issues that involve the position of women. They can fund research, hold conferences, and lobby. Chapter Three describes a number of initiatives by women's organizations addressing office automation issues.

The effect of automation in the office has been stressed as a women's issue, as:

> ...not only an employment-adjustment problem in itself, but also a women's issue problem... computer technology is increasing employment opportunities in the occupations where women are least represented and is diminishing employment opportunities in the areas where women are most

> concentrated, and they are concentrated there in part because of their inability to move on from entry-level clerical work to other work.*

A growing skills gap between the clerical and professional level of information work is perceived as a major problem:

> The net effect (of office automation) could be the institutionalization of a dual labour market within the company, a scenario featuring a group of low-skilled clerical workers feeding data into the computer system on the one hand, and a smaller group of increasingly sophisticated professional users of computerized information on the other, and a hostile, unbridgable skills gap between the two groups.**

This skills gap is fortified by the large concentration of women in clerical areas, and by attitudinal barriers. Women in clerical positions are often not perceived by employers as having the competency to acquire more valued skills.

It is the question of the competency and potential capability of the employee that is likely to cause most tension between employers and those viewing the situation from a women's perspective. Most employers will contend that clerical staff cannot be transformed into professional workers: "You can't make a doctor out of a nurse." On the other hand, the concentration of women in the office in lower-skilled clerical positions would suggest that within those ranks are women with broader capabilities who, with training, could advance to new occupations and who also may in fact be working at employment levels below their capabilities. Also (though studies are needed on this subject), the efforts in self-development made by women in clerical positions to advance to new careers, through such means as part-time enrollment in computer courses, emphasizes the underutilization of skills that can occur at the clerical level.

* Labour Canada, Proceedings of a Conference on the Impact of Micro-Electronic Technology on the Work Enviornment (1981), p.95. (Speaker: Heather Menzies).

** Ibid. See Chapter 2 for further explanation of skills gaps and occupational segregation.

Thus the impact of office automation does not simply concern unemployment -- and how society can deal with increased unemployment among women, particularly when many women work because they must, either as single parents or as spouses of low-income earners. Rather, it concerns occupational segregation, and the solutions proposed include affirmative action, particularly applied through occupational bridging.

In sum, the women's perspective is based upon a concern about both the position of women in society, and about the labour impacts which may detrimentally affect women. Women's organizations appear well aware that the brunt of the employment impacts of office automation may fall upon women at clerical levels, and are equipped with research data and organizational structures to voice their concern.

3.2 Organized Labour

The employment impact of microelectronics is of major concern to organized labour, and though for the most part those workers affected by office automation (at either the managerial/professional or clerical levels) are not unionized, nonetheless union spokespersons and the Canada Labour Congress have drawn attention to the dramatic employment effects office automation is expected to produce, particularly upon female workers.

3.2.1 Office Workers and Unions

Outside of public administration,* only about 16% of office workers are unionized. Within public administration, the figure is much higher, as Exhibit 3-1 indicates: it stands at approximately 89%.

A number of statistical shortcomings are encountered in an assessment of unionization and technological change provisions among office workers. Many statistical tables illustrating unionization present analysis by industry, which does not shed light on the particular situation of office workers within industry categories. (Exhibit 3-2 is an example). Secondly, in the cases where "office worker" is distinguished, further differentiation between the managerial/professional and the clerical levels may be lacking.

The low degree of unionization among office workers has several facets. Managerial staff do not belong to unions, and professional employees are also unlikely to be unionized. This is in contrast with several European countries where professionals are organized.

In addition, women in clerical positions are largely unorganized, outside of the public service. The degree of unionization among women in general is less than that of men: only 27% of women in the Canadian labour force are unionized, compared to 93% of men.**

* This includes occupations concerned with carrying out managerial and administrative activities which are unique to government. Workers may be elected or appointed and work in federal, provincial and local legislatures departments or agencies. Source: "Occupational Classification Manual," Census of Canada, 1971, Ottawa.

** White, Julia, Women and Unions, (April 1980).

EXHIBIT 3-1
COLLECTIVE AGREEMENT COVERAGE

Industry	Office Employees	Non-Office Employees	Other Employees
Logging	17	84	-
Mining	12	84	-
Manufacturing	10	78	-
Transportation & Communications	43	88	88
Trade	4	27	26
Finance	2	12	-
Sciences	29	48	74
Public Administration	89	94	96

Office Employees refer to supervisory, professional and technical staff, and personnel engaged in clerical, accounting, secretarial, sales, executive and administrative activities.

Non-office Employees refer to non-supervisory workers directly engaged in the production of goods or services and the provision of maintenance and auxiliary services closely associated with production operations.

Other Employees include certain operating workers, sales employees, nursing and technical staff and firemen and policemen. These groups of employees are found in four industry divisions: transportation, retail trade, hospitals and local administration.

Source: Canadian Labour Congress, "The Effects of Microelectronics on Employment and Income," September 1980.

EXHIBIT 3-2

PROPORTION OF WOMEN WORKERS AND DEGREE OF UNIONIZATION BY INDUSTRY, CANADA, JANUARY 1977

Industry	% of Employment Which is Female	% of All Workers Unionized
Community, Business & Personal Services	59.5%	29.0%
Finance	57.3	1.5
Trade	40.0	7.9
Public Administration	32.5	65.8
Manufacturing	25.0	46.0
Agriculture	25.0	0.6
Transportation	19.3	53.7
Other Primary	7.9	41.3
Construction	7.4	47.9
All Industries	37.5%	32.1%

Source: Statistics Canada, Labour Force Annual Averages 1975-78, Cat. 71-529, Table 16, and Women's Bureau, Labour Canada, Women in the Labour Force: Facts and Figures, 1977 Edition, Part III, Table I.

Various reasons have been advanced for this low ration of unionization. For example, most women entered the labour force in industries that have been expanding since World War II, and which do not have a history of union activity (trade, finance, services). Exhibit 3-2 indicates that the industries where women are concentrated are not highly unionized (public administration excepted). Other reasons suggested for less unionization among women include greater tendency among women to engage in part-time work, and the possibility that women perceive their work as temporary. Company size is also a factor: the numerous clerical workers spread out through small firms are particularly unlikely to be unionized. Women's representation in organized labour has, however, been increasing rapidly, and grew by 160% between 1966 and 1976.*

In sum, it would appear that the impact of office automation will largely be felt by employees who are not part of a union. Exceptions most notably include public administration; also, in certain cases (such as with telephone companies, the transportation industry and hospitals), more than half the office employees are covered by collective agreements.

The lack of unionization among office workers, and particularly among clerical workers, has been emphasized by unionists as an additional problem regarding the impacts of office automation:

> Given the effect that microelectronics is expected to have on office employment, it becomes even more important that statutory provisions are enacted to protect workers.**

* Women's Bureau Labour Canada, Women in the Labour Force: Facts and Figures, 1977 Edition.

** Canada Labour Congress (1980), p. 32. (This document is not a statement of congress policy.)

The lack of protection regarding technological change has also appeared as an argument for unionization*:

> Unionization and collective bargaining can provide protection to employees threatened by the effects of technological change. It provides the right to negotiate a collective agreement with the employer which is legally binding for a specific period.**

Technological change, however, has not been an area where union power has been exerted to a great extent in the past.

3.2.2 Unions and Technological Change

Unions in general have not taken a position that counters technological change:

> A policy of outright opposition to technological change is impracticable and/or undesirable. No country can maintain employment by keeping its technology unchanged while its competitors move on and reduce costs. In any event, the productivity increases made possible by new technology provide the means for improvements in workers' living standards.***

* Only about 1/3 of the Canadian labour force is unionized.

** Mather, B., Stinson, J., and Warskett, G.,(1981), p. 7.

*** Cockroft, D., International Labour Review, p. 700.

With the acceptance of technological change as a fact of life, a union tries to cushion negative impacts or, optimally, ensuring a share of the economic benefits of innovation for its members.* Avoiding job reduction is the primary concern. Health issues may also arise, and deterioration in the content of a job has also been seen as a potential problem area (though it has not been emphasized in Canada to date). But assurances of protection from employment impacts are clearly the foremost issue from a union perspective.

The avenues through which union positions are expressed include:

i. collective bargaining agreements
ii. consultative processes
iii. lobbying at the political level.

Unions will themselves be changed by a new wave of technological change, both in terms of where they will need to focus attention, and in terms of the makeup of a union as occupational shifts occur. Changes could include:

- changes in the significance of the strike and the development of other negotiating tools;
- rapid changes in employment mixes and in industrial organization;
- swings in union size and union jurisdiction;
- increased unionization among knowledge workers (not extensively organized in North America);**
- an increasing barrier between union members with job protection, and new entrants to the work force;
- increased participation by unions in the political arena.

* For example, upgrading job classifications and pay scales.

** Faulkner, F., and Gurstein, M., (1981), p. 10.

i. Collective Bargaining Agreements

Technological change overall has not been a pressing matter in collective bargaining in Canada. Workers are reluctant to:

> ...go on strike or to take whatever pressure tactics are necessary to get collective agreements to deal with hypothetical situations that in their view may not take place during the life of that agreement.
>
> The real world of collective bargaining is (unions) usually have a lot more issues to deal with than (they) are ever able to cope with in a given set of negotiations; adding all kinds of hypothetical problems to the agenda will make the process more complicated and it doesn't work.*

The kinds of technological change provisions included in collective bargaining agreements can be grouped as follows as concerning:

A. PROCEDURAL MEASURES:

- prior notice
- negotiation
- consultation
- co-determination, etc.

B. AVOIDANCE OF LAYOFFS

- guaranteed employment
- job reduction through attrition
- broadened seniority
- broadened areas of opportunity
- early retirement
- spreading jobs among more workers

  (shorter work week, early retirement, more holiday time, etc.)

* Labour Canada (1981), p. 61. Speaker: Fred Pomeroy, President, Communications Workers of Canada

C. FACILITATED RE-EMPLOYMENT

- transfers
- relocation
- moving allowances
- retraining

D. EASING THE BURDEN OF UNEMPLOYMENT

- severance pay
- continuance of benefits coverage
- supplemental unemployment benefits
- vested pension rights
- income during retraining periods

A number of studies have examined the provisions regarding technological change which appear in collective bargaining agreements. Exhibit 3-3 indicates that most agreements have few provisions for technological change. Where technological change provisions do occur, they usually concern employee responsibility for prior notification and consultation.*

The limited provisions for technological change reflect an assumption basic to the way business is conducted in Canada that the introduction of technological change is a managerial prerogative, "exercised at will as part of management's right to manage".**

* See, for example, Buchanan, Lillian (1981).

** Peitchinis (1978), p. 11.

EXHIBIT 3-3

COLLECTIVE BARGAINING AGREEMENTS AND TECHNOLOGICAL CHANGE

Collective Bargain Agreements With No Provision for:	Percentage of Agreements
1. Severance pay and supplementary unemployment insurance	55.5
2. Guaranteed employment or earnings	85.4
3. Advance notice and/or consultation prior to introduction of new methods	71.5
4. Training or retraining (technological change)	77.6
5. Relocation allowance (technological change)	97.2
6. Labour-management committee (technological change)	87.3
7. Wage or employment guarantees (technological change)	81.4
8. Notice of lay-off (technological change)	91.3
9. Re-opener clause (technological change)	99.9

A 1978 Labour Canada Study covered agreements of 500 or more employees in both federal and provincial jurisdictions; 1,003 agreements covering over two million workers were studied.

Source: Canadian Labour Congress (1980), p.39.

Among the unions an ad hoc approach has prevailed. The point is also made that the pervasiveness of the new technology exceeds the grasp of collective bargaining units. Furthermore, collective bargaining at its best will affect only that one-third of the Canadian work force which is unionized. Labour leaders conclude that:

> The Canadian labour movement long ago learned that structural problems cannot be solved by piecemeal alterations at the level of the single enterprise. Collective bargaining is not enough; it must be supplemented by legislative and political action. The microelectronic revolution makes more urgent than ever the vital necessity of government initiative.*

ii. Consultation and Participation in Decision making

Consultation between union and management may be required through a technological change provision in a collective bargaining agreement; it may arise under the Canada Labour Code; or it may occur outside of a contractural or legal obligation. For example, the Quality of Working Life approach to change in the workplace (discussed in Chapter Five) includes a consultative process.

The gains of consultation from a union viewpoint range from access to data and management plans which can help the formulation of union positions, (in collective bargaining, for instance), to a share in decision making itself. Risks include the absorption of corporate goals through the consultative process, so that the assertion of worker interests is compromised.

* Mather, B., (Jan. 1980), p. 13.

Union consultation, negotiations, the information rights of trade unions, and the concept of industrial democracy (the direct participation of workers in decision making) are more prominent in several western European countries than we are accustomed to in Canada. In Norway and Sweden, for example, worker representatives must make up one-third of a corporate board of management. Legislative acts in Sweden make negotiations between unions and employers mandatory if changes affect working conditions, and a Work Environment Act gives employees decision-making rights about their work environment. In a number of countries, trade unions are going a step beyond consultation and are demanding the right of co-determination in the introduction of new technologies.* Meanwhile, in Japan, worker and management co-operation to reach joint goals is emphasized.

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*Melvyn, Peter, (1981), p. 10. For example:

In some countries co-determination has been obtained such as in Sweden where it is anchored in the legislation and trade unions, for instance, the Nordic Bank Employee's Union, totalling 128,000 members throughout Denmark, Finland, Iceland, Norway and Sweden request that employees be associated with decisions taken at the planning stage whenever new technical systems are introduced and that they be represented in all decision making bodies. In all these countries either national agreements or legislation such as Work Environment (Denmark, Norway) and Industrial Democracy Act (Finland) give substantial assistance to unions to influence technology. In Sweden, in particular, worker participation and co-determination is taking on a new dimension with increasing division of the production system into smaller autonomous units which make finished products or components and which have their own resources for service and administration. This rethinking of work organization and job content has arisen in connection with recent technological change. In these small units workers are given the opportunity to understand the total context and to become more involved in production planning and decision making.

Unionization in these countries is vastly different from the Canadian scene. For example, a Confederation of Trade Unions in Sweden organizes 90-95% of blue collar workers; A Central Organization for Salaried Employees organizes 80-85% of white collar employees; and there is a Confederation of Professional Associations as well. An Employers Confederation, meanwhile, covers almost the entire private sector, and employers in public sector are similarly organized. In Norway, there is a Federation of Trade Unions and a Confederation of Employers -- both of whom have supported specialized projects for democratization of industry.

Small size, homogeneity, a tradition of equalitarianism, and stable industry relationships have been suggested as explanations for the co-operation possible between industry and workers in Norway.* Such factors create a very different scene than that found in Canada. The Scandinavian countries are frequently referred to as examples of social responsiblity of the employer towards the worker.

The Scandinavian countries, and Britian and the European countries as well, are also remarkable for the amount of union research and information on employment and technological change. Unions in European countries such as the Federal Republic of Germany, Italy and Belgium have produced in-depth research and educational material, and provide policy guidelines for negotiators.

* Trist (1981), p. 26.

iii. Legislation and Political Pressure

The Canada Labour Code and several provincial Labour Codes (in British Columbia, Saskatchewan, Manitoba and Quebec), deal with technological change.

The amendment to the Canada Labour Code treating technological change was proclaimed in 1972. A tense labour situation in the early sixties in the railroad industry (where jobs were severely affected by technological change) had prompted a federal commission of inquiry. It's report urged that unions be empowered to negotiate the effects of all forms of change affecting jobs, and recommended that the decision to introduce technological change should not be made unilaterally but should be a matter of negotiation.* A later 1978 commission further supported a strong role for unions, and recommended a form of compulsory joint negotiation.**

*Report of Industrial Inquiry Commission on Canadian National Railway "Run-Throughs" (1965).

**Labour Canada's Commission of Inquiry into Layoffs and Redundancies upheld management's right to decide what technological changes are required for efficiency. It proposed, however, that if a contemplated change entailed layoffs, the employer should by law give notice to the union, enter into joint consultation to prevent or alleviate layoffs, and delay implementation or change until agreement was reached. Other recommendations included employee help in finding new jobs for laidoff workers and more accessible retraining programs, and portable pensions. Earlier federal inquiries had recommended collective bargaining and, if necessary, the right to strike during the life of a collective agreement, as vehicles to deal with technological change.

In 1972 Parliament upheld the employer's right to make changes and opened avenues where the bargaining agent could seek to negotiate the effects of change. The Canada Labour Code requires that an employer must give written notice of a technological change 90 days before its introduction;* the union may then apply to the Canada Labour Relations Board to bargain collectively concerning the change.

Despite the intention of the legislation to encourage collective bargaining agreements dealing with technological change, this does not seem to have resulted.**

Up to November 3, 1981 (when it issued its first reasons for decision on the subject), only eleven applications relating to technological change had reached the Canada Labour Relations Board.

* The Canada Labour Code defines technological change as:

(a) The introduction by an employer into his work, undertaking or business of equipment or material of a different nature or kind than previously utilized by him in the operation of the work, undertaking or business, and;

(b) a change in the manner in which the employer carries on the work, undertaking or business that is directly related to the introduction of that equipment or material. (emphasis added) (The Canada Labour Code, Part V, Section 149. (1)).

** Nowhere does the legislation seem to have caused much more frequent negotiation (backed up by the right to strike) regarding technological change during the terms of contracts or large increases in arbitration activity on the subject. Neither has the incidence of technological change provisions in contracts increased much faster since 1973 than has the number of workers in large bargaining units.

The provincial codes have mainly broadened the definition of technological change; provided for the re-opening of collective agreements during the life of an agreement (Manitoba and Saskatchewan); and/or required prior notice even if a technological change provision in an agreement is in place.

Legislative provisions have generally not been considered adequate among unionists. As basic a matter as the definition of technological change, for example, has caused prolonged arguments between union and managements as to whether a change falls within the category.*

The unsettled treatment of technological change reflects the troubled and adversarial relation between labour and management in Canada. Joint planning is almost impossible. Yet with automation and international competition, increased productivity becomes more and more important, and adversarial model of relations becomes increasingly damaging. Countries like Japan, which achieve productivity through labour management concensus, hold significant advantages.

3.3 Summary

Union power regarding technological change is relatively weak, and the chances that more protective technological change provisions will develop are limited by the pace of technological change and the realization that companies must automate to remain competitive. Furthermore, in the case of office automation in particular, there is a low degree of unionization among office workers.

* Moorhouse, (1980), p. 57. Also, if an existing collective agreement contains provisions for the effects of technological change, no recourse to the Board is possible.

As a result, the negative impacts of automation are likely to be a social problem brought to government's door, and not a matter than can be handled through labour management relations. The deeply adversarial relationship between labour and management also makes it unlikely that collective bargaining can deal adequately with technological change issues.

Despite these problems, the quality of working life and sociotechnical approaches take a positive approach, maintaining that labour and management can plan together to the benefit of both. The proponents of these approaches also argue that such joint planning is ultimately essential from either labour or management's point of view.

An exception to the picture of weak union power regarding technological change is found with public administration. The public service is largely unionized and operates without the pressure for efficiency felt by private sector. Union resistance to technological change could be acutely experienced. This raises the further issue of a gap between protected workers within a strong public service union and more vulnerable workers in or private sector.

CHAPTER FOUR PRESENT EXAMINATIONS OF THE ISSUES

Research activity on the impacts of office automation has been scant and has consisted of dispersed efforts, as individuals within different fields of study or separate branches of government have turned their attention to the set of issues identified in Chapter Two.

Office automation is a new area and in this report it has also been considered that a number of broader research pursuits are relevant, such as major studies of the impact of microelectronics on employment. In such studies, office automation is one component of the general diffusion of microlectronic technology. Over time, specialized research on office automation impacts can be expected to increase as rapidly as office automation itself.

This chapter discusses the investigation of major relevant issues to date, and divides this subject into two parts:

a) a discussion of the main subjects of study and research, and how they have been approached;
b) an identification of the main institutions and centres of activity taking up relevant questions at this time.

A contact list is also provided as an Appendix.

4.1 Main Subjects of Study

This section discusses the major ways in which the issues identified in Chapter Two have been treated as subjects of research. The intention is not to provide an exhaustive description of work done (which would soon become dated), but rather to indicate where attention has been focussed, what type of work has primarily been done, and what type of studies have been scarce in the past.

Generally, a scarcity of research has prevailed and a great deal of discussion of the issues related to automation is based on speculation. It should also be recalled that underlying most research that has been done are three established disciplines: economics, sociology and psychology. Research can be expected to reflect both the strengths and weaknesses of these fields of study. Exhibits 4-1, 4-2 and 4-3 suggest how these disciplines, with the various research approaches and tools which they have developed, can be applied to the three levels of office automation impacts distinguished here. In general, the more speculative socio-economic approaches have predominated in work on macro-level issues, such as employment impacts. At the organizational/individual levels, very little work has been done. A handful of individuals following the sociotechnical approach stand out both because they have broken ground in this area and because they bring an established frame of analysis to their work.

4.1.1 Macro-level Issues

The prominent issue in office automation has been employment effects, and in the late 1970s a number of studies were undertaken in Europe extrapolating broad impacts of automation on the labour market. Exhibit 4-4 illustrates the results of several major reports. Three studies generated considerable controversy and are often referred to in discussions of office automation effects.

Not surprisingly, these efforts to predict net job loss or gain over a decade-long period are open to criticism.

EXHIBIT 4-1

SCHOOLS OF STUDY ADDRESSING THREE LEVELS OF OFFICE IMPACTS

(A) MACRO LEVEL

- ECONOMICS
- "TECHNOLOGICAL CHANGE" STUDIES
- WOMEN'S STUDIES
- LABOUR RELATIONS
- SOCIOLOGY

(B) ORGANIZATIONAL LEVEL

- ORGANIZATIONAL COMMUNICATIONS
- HUMAN RESOURCES MANAGEMENT
- INTERVENTION STRATEGIES

(C) INDIVIDUAL LEVEL

- QUALITY OF WORKING LIFE (QWL) ASSESSMENTS
- SOCIOTECHNICAL ANALYSIS
- EVALUATION RESEARCH
- PSYCHOLOGY (Attitude Measurement, etc.)

EXHIBIT 4-2

APPLICATION OF MAJOR DISCIPLINES TO THREE LEVELS OF OFFICE AUTOMATION IMPACTS: MAIN AREAS OF STUDY

	ECONOMICS	SOCIOLOGY	PSYCHOLOGY
MACRO LEVEL	. economic impact assessment . employment studies . occupational analysis . retraining development . 'technological change' studies . labour relations studies		
ORGANIZATIONAL LEVEL		. organizational communications . human resources management . intervention strategies . evaluation . sociotechnology analysis	
INDIVIDUAL LEVEL			. Quality of Working Life

EXHIBIT 4-3

RESEARCH METHODS AND APPROACHES:

CONTINUUM

APPROACH	METHOD	RESEARCH TOOL	TRADITION
THEORETICAL	. generalization:		
	. broad sweep	. literature readings	
	. historical perspective	. development and application of theories	ECONOMICS & SOCIOLOGY
	. futurist outlooks		
	. modelling (non-numeric)	. model building	
		. scenario generation	
	. analysis (non-numeric)	. forecasting	
		. analysis; identification of trends	
	. forecasting, based on non-numeric trends		
	. identification of non-numeric trends		
EMPIRICAL	. modelling (numeric)	. as above, plus statistical analysis	
	. analysis (numeric):		
	. forecasting based on numeric trends		
	. identification of numeric trends		
	. descriptive (numeric)		
	. case studies	. surveys	
		. questionnaires	
		. quasi-experimental design	
PARTICIPATORY	. sociotechnology design	. as above	
	. intervention strategies		PSYCHOLOGY

EXHIBIT 4-4
FORECAST OF THE IMPACT ON EMPLOYMENT

Report	Type of Jobs Affected	Number
SIEMENS, 1978	40% of office jobs in Germany carried out by computers by 1990	Two million typing and secretarial jobs lost
NORA and MINC, May 1978	Banking and insurance jobs in France	30% reduction in jobs in next 10 years
APEX, March 1979	Typing, secretarial, clerical and authors of letters and documents	¾ million lost by 1983
BARRON and CURNOW 1979	Secretaries, typists, clerks and managers	10-20% unemployment levels in next 15 years
JENKINS and SHERMAN 1979	Information processing jobs	30% displacement by 1990
Philip VIRGO 1979	Private sector services - clerical and administrative staff - particularly in insurance, banking and building societies	40% jobs at risk in in the 1980s
	Public sector services	Up to 2/3 of all clerical and administrative jobs at risk
SLEIGH	Banking	Modest overall increases in employment for the next five years
		Some diminution in employment during the 1990s if banks do not develop new services
	Insurance	A shift in employment from low grade clerical and data preparation jobs towards higher grade computer systems jobs. If present level of growth not maintained employment could decline by as much as 15% in the next five years

Source: Equal Opportunities Commission (1980).

In 1978, the Department of Communications funded a review of the debate on the impact of microelectronics in OECD countries. This report noted a number of weak points in forecasting, such as excessive extrapolation from starting assumptions. Interactions among different sectors of the economy were often ignored, and factors such as social resistance to technological change and differences between individual companies tended to be neglected.* Most basically, forecasts for such an uncertain topic rest heavily upon the assumptions that are made, and at heart, (the same report claims) the nature of the employment impact debate is largely political:

> "The reviewer of the current literature cannot but be struck by the relatively poor factual base on which the present debates are conducted. The controversy appears clearly to be ideological in nature. It is therefore important to keep in mind the worldview of the individual author. Furthermore, it is always necessary to keep in mind the affiliations of the people who speak."**

These debates nonetheless drew serious attention to the question of employment effects of new computer-based technologies. In addition, a consensus among many writers could be found on certain points:

1. Negative employment effects may depend in large part upon the rate of technological change. Optimistically, slow gradual change allows for more opportunity for labour to shift to new growth areas, and could extend the time frame of impact beyond the present recession.

* Zeman (1979), p.38.

** Ibid., p.32.

2. The development of microelectronics may be different from previous waves of technological change (which did not produce the negative impacts expected) both because of breadth of application and rate of diffusion. For example, the miniaturized computer (the "chip") is diffusing seven to ten times faster than most previous technologies.

3. Whether a net job loss occurs or is offset by new employment gains, large-scale occupational displacements can be expected.

4. The service sector -- which absorbed displaced labour as agriculture and manufacturing sectors adopted new technologies -- is itself undergoing automation and can no longer be counted upon to provide growing numbers of jobs.

5. Certain segments of the labour market are more likely to be affected than others -- older workers who have less flexibility in retraining; middle management; and women, who overall form the "bulk of information manipulators in the service sector". Women "are expected to bear the brunt of the impact".*

The substantial number of such broad forecasts and the debates they evoked have been instrumental in sensitizing policymakers to the employment impact issue. Given the essential uncertainty of such predictions, the most effective research directions at present lie with more focused and empirically-based studies. Case studies may yield supportive evidence or alternatively may reveal contrasts to the basic assumptions on which these predictive studies have been based.

* Zeman (1979), p.44.

The need for case studies is frequently noted by those discussing employment effects. Few such studies have been done to date. The book Women and the Chip, which has generated the most intense debate in Canada on office automation impacts, is subtitled "Case Studies of the Effects of Informatics on Employment in Canada". It uses four case studies; however, only two are actual firm-level investigations. The author, Heather Menzies, also produced a case study report for the Department of Labour's Women's Bureau. At present, a Task Force on Microelectronics and Employment is funding further case study work. There appears to be a general acknowledgement that such examinations are needed at this time.

A study completed in April 1981 for the Department of Communications included case study work on office automation, but encountered a significant problem:

> In due course it became evident that the nature of information we required was either not available or would not be made available to us. Some companies deemed the information to be confidential; others thought the task of compiling such information too onerous and labour-consuming; and still others simply said they did not wish to be involved. Concerns appear to pervade that publicity of negative employment effects may bring special pressures against eletronic technology and retard the rate of implementation.*

While in the event more information was made available than was anticipated, this reluctance of firms to participate is an important point regarding case studies. Companies should be carefully chosen and carefully treated, to ensure that optimal data is obtained and the doors are not closed protectively against future case study work.

* Peitchinis (1981), p. iii.

In addition to firm level case study work, detailed examinations of an industry subsector can provide useful information. (Women and the Chip, for instance, not only looked at individual firms but took up the question of automation in banks and supermarkets generally.) There are at present few examples of such work.

Another major set of topics identified at the macro level of impact concerns changing skills requirements. Again, relevant work is in short supply. In Canada, some studies in this area have been done by Steven Peitchinis, a professor at the University of Calgary, who has produced a number of reports dealing with technological change and educational and skills requirements, for the "Technological Innovation Studies Program" supported by the federal Department of Industry, Trade and Commerce. The Economic Council of Canada has also treated the question of changed skills requirements resulting from technological change.* In a major survey of innovation in Canadian firms, it was found that skills requirements were raised as a result of introducing 71% of all innovations.*

At the time of an earlier survey in 1978, however, firms contacted indicated that technological changes had not greatly affected educational skills requirements, though it was anticipated that a majority of employees would require an increase in technical knowledge in the future. Meanwhile, de-skilling effects were also noted. Later work based on case studies concluded only that: "The effect on the level of knowledge is difficult to establish at this time."**

* Demelto, D., McMullen, K. and Wills, R. (1980), p. 163.

** Peitchinis (1970), pp. 20-23.

Given that a widening skills gap between knowledge workers (professionals and managers) and clerical workers is a major anticipated effect of office automation (forming, for example, a central point of concern in such works as Women and the Chip), clearly further studies in this area are required.

A final set of issues identified at the macro level concerns changes in social patterns -- the possibility of reduced work, changing meaning of work, changed hours and place of work, and trade-offs between transportation and telecommunications through electronic office communications.

Most discussions of reduced work and changed meaning of work have been speculative and intuitively written "think pieces", exploring the possible ways in which work, leisure, and education in the future may alter, and what this may mean to society. The erosion of the barriers between work and leisure activities, and the growth of the "informal economy" (i.e. economic activity outside of standard working patterns) are some topics that have appeared in books and articles.

In addition, a number of attitudinal surveys have explored the themes of rising work expectations and increasing emphasis on personal self-fulfillment among the emerging work force.* A study of the attitudes of Canadians towards work could be an illuminating piece of research.

Transportation-telecommunications effects are a more readily quantifiable subject. A number of case studies in this area have been done, and also extrapolations have been made of the energy savings possible through the use of telecommunications rather than physical transport or travel.**

* Kerr, C. (1979).

** Work in this area was reviewed in Telecommunications Policy, March 1982.

4.1.2 Organizational and Individual Issues

There has been little work to date on the impact of office automation at organizational and individual levels. The work of only a few researchers were identified during the investigations for this report. These tended to be people working in the sociotechnical school (described in Chapter 5) notably: Enid Mumford in England, Calvin Pava at Harvard, Richard Whalton (also at Harvard), and Jim Taylor in California. Within Canada only a few private consulting companies have experience in empirical work in the integrated office.

Another approach applied to the office is that of organizational communications, studying both formal and informal communications and decision making within an organization. In Canada, a group at Waterloo has been particularly active in this area, and is at present applying the methodologies they have developed to measure changes produced by new office technology.

Finally, the development of attitudinal scales measuring individual response to technology has been a subject of research in the past. GAMMA, for instance, developed a "Technophobia" measurement scale, under contract to the Department of Communications. However, the replicability of such scales is uncertain, and further research is currently being undertaken to refine such measures.

Overall, the study of impacts of office automation at the individual and organization levels (considered separately or jointly) is at a pioneer stage. There are some precedents to draw upon (methodologies developed for the study of organizational structure and communications, for example, and attitude measurement instruments), but work in the area of office automation specifically is only beginning. Sociotechnical analysis, by virtue of its attempt to provide a theoretical framework and a systematic means of analysis, stands out as an area of study.

4.2 Centres of Activity

During the course of this project, numerous individuals and organizations were contacted who were examining office automation from a social perspective.

The next section describes a number of centres of activity where the impacts of office automation (or closely related issues) are being studied or treated as policy questions. This includes activity in several different settings:

A. Within government (including federal government departments and councils, and committees associated with the federal government)
B. The Task Force on Microelectronics and Employment
C. Ontario Quality of Working Life Centre
D. Labour Organizations
E. Universities
F. Other Organizations
G. Private Corporations and Institutions
H. International Activities

A. Within Government

Department of Labour: Women's Bureau

In 1981, the Women's Bureau of the Department of Labour held a seminal conference on "The Impact of Micro-Electronic Technology on the Work Environment". This was a major gathering that included international perspectives, and that gave considerable emphasis to office automation. Its proceedings have been published and represent one of the few comprehensive published documents available on the impacts of new technologies.

This conference resulted in a Task Force on Microelectronics and Employment, described below, in which the Director of the Women's Bureau is participating.

Department of Labour: QWL Program

The Department of Labour also has a Quality of Working Life program, begun in 1978 as part of their ongoing efforts to promote labour-management co-operation in matters lying outside the collective agreement.

The department identified problems that ranged from an increasingly competitive international trading environment to employee frustration within the workplace, and focussed on a need for fundamental reforms in organizational life. Program activities were designed to promote a climate conducive to workplace change, raising awareness of QWL values and possibilities. Activities have included: publications, conferences and workshops; financial support for unions participating in QWL conferences; financial assistance to QWL centres within universities; and training assistance for individuals to become qualified QWL facilitators. The aim is for a supportive environment to result in more widespread applications of QWL within organizations in Canada. A small number of actual projects are also funded by Labour Canada.

Canada Employment and Immigration Commission (CEIC)

CEIC has given particular attention recently to the problems of training and retraining (discussed in Chapter 2). Recently enacted legislation gives the federal government a greater role in training, including the identification of occupations where skilled workers will be required. An Occupational Projection System is being developed for this purpose.

Apart from this broad role, various divisions within the CEIC may have responsibilities which relate to the impacts of office automation. For example, the Women's Employment Division has funded projects on:

- The Integrated Electronic Office and Women:
  - i. Training Resources and Needs
  - ii. Implications for Training and Career Mobility
- Skill Requirements for Women to Participate in the Electronically Integrated Office

Treasury Board of Canada

Treasury Board is essentially the employer of the Canadian public service, setting policy for personnel management, the organization of the public service, administration of collective bargaining, etc. It has a Quality of Work Life unit within its Personnel Policy Branch.

This branch has been responsible for three generations of QWL projects within the federal public service, beginning with three projects in 1976, followed by further projects in 1979 and 1981.*

Status of Women, Canada

The Status of Women, Canada is a separate department of government that reports to the Minister responsible for the Status of Women. It was established in 1979 to assure that government policy for the equality of women was reflected in government actions, such as personnel policy.

Several federal government departments have also been involved in an inter-departmental committee on microcomputers co-ordinated by the Ministry of State for Economic Development. A paper drafted for Cabinet noted in particular the lack of an overview of this subject, and suggested that government monitoring of the issues could be required.

* See Cameron, M., (1981).

Apart from government departments themselves, various government councils and various committees associated with the federal government have given attention to the impacts of office automation or to related topics.

The Science Council of Canada

In 1980, the Science Council held a workshop on the "Impact of Microelectronics on Work and Working", and subsequently published its proceedings. The council also recently published an overview document about the Information Society.

Economic Council of Canada

Several researchers at the Economic Council of Canada have undertaken work in areas that relate to the impacts of office automation (i.e. unions and technological change*, and a proposed study of labour markets for women**).

Social Sciences and Humanities Research Council (SSHRC)

SSHRC is one of several federal funding councils that award research money to universities across Canada. SSHRC has recently initiated a special funding program for the "Human Context of Science and Technology" which could potentially fund studies on the impacts of new technology. A special "strategic grants" program is also being prepared for studies on women in the work force.

* See Buchanan, L. (1981).

** Boulet, J. and Lavallee, L. (1981).

Committee on Human and Social Impact of Office Automation

The Office Communications Systems program within the Department of Communications (which is supporting the present study) is a joint government-industry venture whose main activity is to establish a number of office automation field trials in government settings. The program works with two committees: an Industry Committee and a "Users Group", which theoretically consists of those departments within government who will use the new technology. Before the selection of field trial sites, the Users Group attracted a number of members from government departments who were interested generally in office automation. It also formed a special committee on "Human and Social Impacts of Office Automation".

According to its terms of reference, this committee will:

> ...investigate social and behavioural problems related to the introduction of office automation. It is looking at issues such as worker resistance to automation, employment effects such as job displacement and retraining, man machine interfaces, privacy and organizational design.

Its responsibilities include seeking information on relevant issues and summarizing such information for the Users Group.

Thus a group has evolved with a specific interest in the social impacts of office automation. The structure of the group, however, suffers from two weaknesses: first, while it arose out of genuine interest, it is a subcommittee to a group which itself has no real mandate to address social issues; and secondly, it has no dedicated manpower as all participants hold other positions.

National Committee for a Human Context for Information Technologies

More recently there has been some discussion of a national committee to consider the social impacts of new office technologies. A similar committee has already been established in the context of videotex and teletext (two new forms of computer communications). The federal Department of Communications has been closely involved in the development of videotex and teletext because of its interest in Telidon (a means of transmitting these services that was developed within DOCs government labs). The department is advised on videotex/teletext development by a Canadian Videotex Consultative Committee, which in turn has a subcommittee on the individual and society that has funded research on social issues and held public awareness sessions. The proposals for a National Committee for a Human Context for Information Technologies are partly conceived as an expansion of this CVCC subcommittee.

The new committee would provide advice to the Department of Communications on:

> ... various aspects related to the development and introduction of new office communications technologies in Canada as they pertain to employment, the nature of the work place, societal and behavioural concerns and related policy issues. It will serve a communications function between interested individuals and groups and government.*

Membership would include representatives from the Department of Labour; the Status of Women, Canada; labour and industrial groups; and "concerned groups" across Canada. Its main responsibilities would be: to convene awareness seminars and public meetings; to conduct research as required; to review field trial activities; and to produce an annual written report.

* Social Impact Subcommittee, Draft Report (1982).

B. Task Force on Microelectronics and Employment

A task force on microelectronics and employment is now underway to examine the status, implications and the extent to which microelectronics technology is used within industry under the Canada Labour Code jurisdiction. This is designed generally to evaluate the appropriateness and adequacy of the Canada Labour Code as it applies to technological change. Since a major point of concern about the impact of microelectronics is that women will be disproportionately affected, the task force will give special consideration to this question.

C. Ontario: Quality of Working Life Centre

The Quality of Working Life perspective on work and the workplace has emerged in this study as a major approach to the problems of technological change, along with its sister approach, sociotechnology.

In 1978, on the recommendation of a joint labour-management committee, the Ontario Department of Labour established a Quality of Working Life Centre in Toronto. It is a well organized body with a staff of experts who support a range of activities. Consultation is a major emphasis. Staff are available to meet with organizations on an informal basis, or to plan more extensive projects. The centre also engages in Field Work Projects. An education program is prepared to offer general introductory sessions, or specific programs on particular topics. The centre also publishes a newsletter and a series of reports on topics relating to the quality of working life or to sociotechnology. Some research is also supported.

Most emphasis in the past has been on "blue-collar" types of work, which in part reflects the orientation of the Centre's Advisory Committee, made up of union and industry members. There is nonetheless an awareness of the potential impacts of office automation.

D. Labour Organizations

The role of organized labour regarding technological change has been discussed at some length in Chapter Three. It was pointed out, in particular, that apart from the public service there is low unionization among office workers.

A few conferences have been held by organized labour on office automation or more generally on the effects of microelectronics on the worker. For example, the National Union of Provincial Government Employees (NUPGE) held a conference on office automation in March 1982, and the Ontario Federation of Labour held a conference on Microelectronics and the Worker in 1981. Also, within unions, seminars and workshops are frequently being held to acquaint workers with the issues of technological change.

The Canada Labour Congress produced a report on "The Effects of Microelectronics on Employment Income" in 1980. This has been a discussion document only and no formal policy position has been taken.

The potential health hazards posed by video display terminals have been a special focus of union attention. The Canadian Union of Public Employees, for instance, has published a report on this subject.

In the United States, the National Association of Office Workers, renamed "Working Women", has had a high profile in the debate on the impacts of office automation and published a widely known report called "Race Against Time". There is no real counterpart to this union in Canada. A few union spokespersons, however (primarily from the Communications Workers of Canada), have taken on a role in making general statements about computerization and employment, which includes attention to the effects of automation in the office.*

* For example, Mather, Boris (January 1980).

E. Universities

A recent survey done by researchers at Carleton University (where a chair in office automation has been established) has examined university research activities across Canada in the area of office automation.* While the scope of this study did not extend specifically to economic and social factors, it nonetheless provides an overview of research in Canada.

A major centre in office automation research has recently been established at the Université du Québec a Montreal. "Bureautique" means office automation in French, and "Bureauviseur" refers to an integrated office workstation. "Project Bureauviseur" has assembled a multidisciplinary team that will undertake a number of developmental projects in office automation using local area networks and integrated workstations. Projects include hardware and software development, but emphasis is also placed on human and social factors. The researchers are involved in designing telecommunications for the new "Palais des Congrès" to be constructed in Quebec City, a major project which will include "Office of the Future" technology.

Another centre for research in office technologies is located at the University of Waterloo. The Centre for the Evaluation of Communication - Information Technologies (CECIT) has worked extensively in the area of organizational communications in the past. It expects to expand this work with assessments of the impacts of new technology in the office.

The Faculty of Environmental Studies at York University has been the academic residence of Eric Trist, a leading figure in sociotechnology. A QWL Centre is now being funded at the university by Labour Canada which will offer courses and undertake research.

* Kaye, R. (1982).

Internationally, a few universities stand out. Most prominent researchers follow the sociotechnical approach. There is Enid Mumford at the University of Manchester, Jim Taylor at the Centre for Quality of Working Life at the University of California at Los Angeles, and Calvin Pava and Richard Whalton at Harvard.

F. Other Organizations

Canadian Council on Working Life

The Canadian Council on Working Life grew out of the major "QWL and the 80's" conference held in Toronto in the fall of 1981. Its objectives are "to encourage, promote and coordinate interest in working life concerns with a view to improving working life in conjunction with employers, unions, institutes, scholars, researchers and other interested parties". The council has called for members and plans to hold a conference later in 1982. It aims to act as a forum to gather and disseminate information; to publish newsletters and publications; hold conferences and workshops; and to advocate workplace change.

Canadian Advisory Council on the Status of Women

The Canadian Advisory Council on the Status of Women reports to the Minister for the Status of Women and advises on matters related to the position of women in Canadian society. The Advisory Council has supported an extensive program of research and publications that includes a focus on women and work. Recent research has investigated the impacts of new office technologies on women at work (in a survey of word processing operators).

Other Women's Organizations

Several women's organizations held a conference on "Women and the Impact of Microtechnology" in the summer of 1982 which included a

focus on the impacts of office automation. Sponsors included the National Action Committee on the Status of Women and the Canadian Research Institute for the Advancement of Women.

G. Private Corporations and Institutions

Most private consulting firms interested in office automation are working from the perspective of increasing productivity rather than assessing social impacts per se. One such group is the Niagara Institute which offers seminars and workshops on office automation and the quality of working life.

H. International Activities

There has been a substantial number of activities in other countries in the area of office automation impacts, or more generally concerning the impacts of microelectronic technology. A major study in Australia, for example, examined technological change. In the United Kingdom, the Work Research Unit of the Department of Employment has published several papers on relevant topics, and the Trade Union Congress has held conferences and engages in planning and negotiating on technological change with government.

The OECD in Paris has a committee on Information Computer and Communications Policy, and in 1981 held a session on "Information Technologies, Productivity and Employment". In Geneva, the International Labour Organization has published several reports on the working conditions of "non-manual workers", including the special problems of women non-manual workers and the effects of technological change. In new studies now underway there is a research project specifically on women and office technology.

Most Scandinavian countries have research agencies, or work research units, which do studies specifically on work and working life. Several of these countries have given considerable attention to the policy issues

raised by computer technologies. Norway, for example, has a number of centres of research that deal with the implications of information technology (e.g. the Norwegian Computing Centre and the Work Research Institutes), plus research efforts in various universities and colleges.

These countries are also characterized by a great deal of planning and research regarding social change. Norway, for example, has a Research Council for Societal Planning. They also have a high degree of unionization which permits labour-management planning to a much greater degree than occurs in Canada. (See Chapter 3 on unions and technological change.)

In the United States, the Bureau of Labour Statistics has for many years undertaken research on the impact of computers and related technologies on office operations.

4.3 Conclusions

This chapter has reviewed the main ways in which the impacts of office automation have been examined in the past. In general, there has been a lack of empirical work on macro-level issues, and case studies of employment impacts, sectoral studies of occupation shifts, and studies on changing skill requirements are particularly relevant at this time. Concerning impacts of office automation on the organization and the individual, again work has been scant. A few researchers were identified, most working with sociotechnical approaches. Chapter 7 includes recommendations for future studies based on the current state of research.

This chapter has also listed a number of centres in government, universities or other organizations where the social issues of office automation or closely related topics are being addressed. There is considerable activity, and some leading players stand out (such as the Women's Bureau of the Department of Labour and the Quality of Working Life Centre in Ontario). In general, attention to the impacts of office automation is very recent, and investigations in this area are only beginning. One finds the subject being taken up by a wide range of

government departments, committees and other organizations as an expansion of previous interests. Two potential weaknesses in this situation exist. First, dispersed efforts may lack co-ordination, or be prone to duplication, or fail to reach a critical mass. Secondly, when committee structures are relied upon, there is a tendency for action to be weak if committee members have other full time responsibilities and no full time "manpower" is assigned. Some centre of co-ordination and leading organization should be identified that has the resources to meet demands for information, to push research efforts further, and to promote understanding of the issues in office automation within the broader context of employment trends in an information economy.

CHAPTER FIVE APPLIED APPROACHES AND RESEARCH METHODOLOGIES

The first part of this chapter presents an overview of two approaches to assessing change in the work environment -- QWL (Quality of Working Life) and Socio-technology. Section 5.1 provides background to these approaches: their history; how they compare to other approaches; current growth trends. Section 5.2 defines QWL and sociotechnology, and discusses their underlying principles at more length. Section 5.3 discusses the implementation of these approaches giving an overview of the applied process.

The second part of this chapter focuses on the methodological issues which are inherent in the measurement of impacts resulting from the introduction of new technologies and office automation. This focuses on the types of methods which have been used to assess impacts resulting from the introduction of new micro-technology based equipment. Field trial evaluations constitute a central part of this review since the OCS program proposes a set of trials. Thus, issues specifically related to field trial design and conduct will be reviewed with reference to the topics presented in the previous sections of this report.

5.1 Quality of Working Life

The objectives of QWL focus upon the individual worker: "to arrange organizations, management procedures, and jobs for the maximum utilization of individual talents and skills in order to create more challenging and satisfying work and improve organizational effectiveness" (Jenkins 1981, p. 8). The organization stands to gain through more satisfied workers who, it is supposed, are more productive.

5.1.1 Beginnings

"Job enrichment" to improve production through employee motivation began in the 1920s with studies conducted by Elton Mayo. The conclusion of his work was that when employees have a sense of involvement in the work process, job satisfaction and positive motivation increase. Further research into the social dimensions of organizations by American behavioural scientists, such as Lickert

and McGregor, resulted in the "human relations" school of management, emphasizing participative styles of management that show more concern for the welfare of employees.

Using the hierarchy of needs developed by psychologist Abraham Maslow, Frederick Herzberg developed "job enrichment" theories. It was argued that while basic levels of employment needs (adequate wages and working conditions) must be satisfied, meeting these needs may not result in positive motivation. Rather, satisfaction and motivation can only be derived from a sense of achievement, the possibility for growth and learning, and the acceptance of responsibility. QWL principles incorporate these findings. Exhibit 5-1 compares traditional principles with emerging QWL principles.

5.1.2 The Tavistock Contribution

The Tavistock Institute of Human Relations in London, England, looked beyond the individual employee to the organization of the work itself in an effort to create more satisfying work and increased organizational effectiveness. During the late 1940s and 1950s, members of the institute began to recognize the influence of technology on both the nature of jobs and the social organization of the workplace.

The early Tavistock research took place in the mining industry in Britain, where productivity failed to keep pace with mechanization. Miners were leaving in large numbers and absenteeism among those who remained averaged 20%. Labour disputes were frequent in spite of improvements in working conditions.

EXHIBIT 5-1

NEW AND TRADITIONAL PRINCIPLES

New Principles	Traditional Principles
Utilize the thinking of every employee who can improve organization effectiveness	"Workers work and managers think"
Management perceives its power to be earned through leadership and know-how	Management perceives its power to come from prerogatives and level of position
Both human asset management and financial performance management are measured and rewarded or penalized accordingly	Human asset management subservient to financial performance management
Job design balances people needs with technology needs	Lowest common denominator job design for maximum control
Worker rewards meet self-esteem and societal needs	Worker rewards are predominantly wage, benefit and security oriented

Source: Jenkins (1981), p. 24.

Tavistock researchers noted that engineers designed technical systems with little understanding of the human or social systems that would result from them. The group developed the concept of an organization as a sociotechnical system. Design, then, should be a process of joint optimization of the social and technical systems; an effective organization is one that is designed to meet the needs of employees as well as the requirements of the technical system.

One of the best known experiments in the sociotechnical approach is the Volvo plant at Kalman, Sweden, where unpaced group work replaced the traditional assembly line. Each group carries out the assembly of a sub-system of a car and is responsible for the quality of their work and some aspects of maintenance of equipment. Direct supervision has been decreased; most of the groups have their own work areas, their own entrances and their own non-work areas. Volvo has experienced no difficulty in recruiting at Kalman, and absenteeism is lower than other Volvo plants.

5.1.3 Diffusion

Tavistock principles played a dominant role in the evolution of QWL principles in both Europe and North America, but methods of diffusion differed. In the United States, ideas on QWL were spread by a relatively small number of experts who tended to be behavioural scientists or persons oriented toward behavioural science; they typically relayed their ideas to other experts. In Europe, ideas of QWL were widely diffused by government bodies, behavioural scientists and labour unions.

QWL diffusion in Canada has been somewhat more like that of Europe, in that Canadian federal and provincial government bodies and unions have taken a more active interest in QWL ideas than have their counterparts in the United Sates.

5.1.4 Growth

A gap in understanding between behavioural science and business has been a limiting factor to the growth of QWL and sociotechnical approaches. Many managers objected to the introduction of social value judgments to the business

arena. Behavioural scientists were often unable to explain their viewpoints in meaningful business terms; they seemed overly zealous to managers whose worlds have revolved around short-term, bottom-line decisions. The gap between behavioural science and business is narrowing, but there is still much work to be done in areas of communication and cross-education.

Another limiting factor has been the ambivalent positions of labour unions. On the one hand, they want better working conditions for their membership; on the other hand, union officials are concerned that QWL and sociotechnical approaches will encourage workers to identify more with management so that union loyalty may be reduced. Also, many QWL programs have been introduced in non-union settings, and with increased work satisfaction employees have been indifferent to union organizations.*

However, union leaders have become more familiar with QWL, and with it can be used by both labour and management. Joint consultation between management and union officials on issues involving QWL and sociotechnical approaches is becoming more common.

5.1.5 Future Growth

Acceptance of QWL ideas has increased over the years. Workers, particularly young workers, are disenchanted with conventional jobs and hierarchical structures. Workers are better educated and consumerism has raised workers' expectations in standard of living both outside work and at the work place.

* In at least one instance, a QWL consultant has promoted his services as a means to combat unions.

Meanwhile, the business environment in North America has changed in the last decade. Management faces international competition; domestic productivity is decreasing. Management must be able to adopt methods whereby the entire organization can respond quickly to market change. Strategies which increase worker productivity and effectiveness are essential.

Interest in QWL and sociotechnological approaches appears to be growing. In 1972, an international conference in New York attracted 60 people, most of whom were academics; a conference in Toronto in 1981 was attended by 1,700 persons -- 1,000 managers and over 250 union representatives.* The 1972 conference dealt with the practice and theory of the democratization of work. At this conference the term "quality of working life" was born and the International Council for the Quality of Working Life was established. The 1981 conference was the first open international conference dealing with critical issues of the quality of working life.

5.2 Principles

5.2.1 QWL

"Quality of Working Life" covers a variety of programs, techniques, theories and management styles whereby organizations and jobs are designed to give workers more responsibility and autonomy.**

Traditionally, organizations sought efficiency by breaking jobs down into specialized and repetitive functions. This minimized worker responsibility and decision making, and minimized the requirements for employee training and development. Direction and creative contributions came from managers and supervisors.

* Jenkins, David (December 1981), p.5.

** Ibid., p. 7.

In contrast, QWL techniques emphasize employee participation through:

a) redesign of jobs and organizations so that the majority of workers can do meaningful work;

b) increased responsibility and decision making at the worker level;

c) employee training and development; and

d) direction from both management and staff.

Exhibit 5-2 contrasts key features of the old organizational paradigm with those of the new paradigm of QWL concepts. The essential component of the new paradigm is the opportunity for individuals or task groups at any level of the organization to influence their working environments by participating in decisions on matters that affect them.

5.2.2 Sociotechnology

Enid Mumford of the Manchester Business School (who in particular has applied sociotechnology in the office setting), explains sociotechnology as:

> "a system which, on the one hand, is regarded as efficient in the sense of productivity and quality, co-ordination and control, and its ability to permit the organization to develop and adapt to changing requirements. On the other hand, it provides group and individual efficiency and motivation by promoting an environment for work in which people can achieve personal development and satisfaction."*

The goal of sociotechnology is the "joint optimization" of social and technical systems. This approach emphasizes:

a) the "work system" (a set of activities which make up a functioning whole) as the basic unit of design rather than single jobs;

* Trist (1981), p.42.

EXHIBIT 5-2

OLD AND NEW PARADIGMS

Old Paradigm	New Paradigm
The technological imperative	Joint optimization
Man as an extension of the machine	Man as complementary to the machine
Man as an expendable spare part	Man as a resource to be developed
Maximum task breakdown, simple narrow skills	Optimum task grouping, multiple broad skills
External controls (supervisors, specialist staffs, procedures)	Internal controls (self-regulating subsystems)
Tall organization chart, autocratic style	Flat organization chart, participative style
Competition, gamesmanship	Collaboration, collegiality
Organization's purposes only	Members' and society's purposes also
Alienation	Commitment
Low risk-taking	Innovation

Source: Trist (1981), p.42.

b) the work group rather than the individual employee; and

c) greater internal regulation of the system by the group.

Instead of breaking the overall task into its simplest parts and assigning one individual to each job, tasks are accomplished within a work unit with a new degree of self-coordination and responsibility for outputs.* The work group unit has proven particularly effective when work is routine. Different forms of organization are also being explored for non-routine office work.**

5.2.3 Some Comparisons of QWL and Sociotechnology

The QWL approach is concerned broadly with the welfare of the individual worker, while the sociotechnical approach focuses attention on the options available in the design of a social system that will utilize a particular technology. Socio-technical system design can be viewed as a tool used to achieve QWL objectives. It is:

> "... the application of formal analytic tools for the design of organizations in terms of division of labour, job design, intra-organizational boundary setting and measure of performance."***

A tenet emphasized in the QWL approach is that quality of working life is enhanced if workers participate in the decision-making process within their work unit. Both employee morale and productivity are expected to increase if the worker is a participant in the work process.

5.3 The Applied Process

This section briefly describes what is involved in implementing QWL and socio-technical approaches.

* Pava (1981), p.63.

** Pava (1982), p.16.

*** Taylor, Jim, Proposal to the National Science Foundation, (Nov. 1981), p.6.

5.3.1 The Role of the Consultant

Many organizations seek an experienced consultant to assist them in assessing and implementing these approaches. At one time the external consultant was perceived to be, and often was, better informed about the client's work system than was the client. This often resulted in the consultant exercising excessive control over the project. When the consultant left the client's premises, the QWL project often left as well.

As a result, consultants often recommend that an internal resource be created so that the project will belong to individuals who are going to work with it on an on-going basis.

5.3.2 Implementation - One Approach

The following process has been used successfully by the Work Research Unit in the Department of Employment in London, England, and serves as a conceptual guide for introducing change to an organization.

First, senior management must be prepared to explore alternative forms of work organization. After management involvement is secured, trade unions must be consulted and encouraged to participate in a joint exploration with management into new ways of working.

Time is then spent with all managers and all trade union representatives to provide the people involved with an understanding of basic concepts of work organization, and to give illustrations of developments in similar industries.

At this stage many organizations establish a "joint steering group", a group which usually includes managers and supervisors representing key interest groups within the company. One of the first tasks of the joint steering group is to analyze the social and technical requirements of the organization.

Information is gathered through group discussions, interviews and questionnaires on how workers perceive their jobs and what changes they view as desirable. The

steering group also performs work anlaysis to examine the efficiency of the production and to identify holdups in the work flow.

5.3.3 Analysis

An applied method of analysis has been developed for sociotechnical design. Major steps include:

a) Scanning - overview of the system to be designed: its boundaries, inputs and products; its staff; its relationship to its environments; pressing and immediate problems.

b) Technical Analysis - identification of unit operations (any phase in which an identifiable state change in the input occurs).

c) Identification of Key Variances - points at which deviations from a desired standard or specification are likely to occur.

d) Table of Variance Control - a list of: the unit operations in which key variances are controlled; whom or what controls the variance; what actions are used to control them; the source of information on which these actions are based; and possible alternative control mechanisms, either technical/mechanical or human/social.

e) Social System Analysis - a three step process:

   i. examination of the role relationships within the whole work system as initially defined (the Internal Role Network);

   ii. examination of the role relationships between work system members and persons outside the system (Cross Boundary Role Network); and

   iii. analysis of how individuals view their roles.

Design proposals are prepared and presented for approach, but must first be evaluated and costed by the joint steering group which, if required, calls upon expertise within the company or from outside sources. If the proposals seem socially desirable and cost-effective, implementation often occurs on an experimental basis.

It is easier to include QWL and sociotechnical approaches when planning a new facility. It is more difficult to change established attitudes and routines in an established environment. For instance, it is usually not feasible to replace capital equipment such as an assembly line. The introduction of automated office systems, however, entails organizational change by nature, and could be implemented using sociotechnical and QWL techniques.

5.4 Summary

Studies of the introduction of QWL and sociotechnical techniques to the work place in the past have been encouraging. If organizations are to cope with new levels of complexity and uncertainty, organizational designs and technology inherent in those designs must provide flexibility. The flexibility of today's office automation technology makes QWL and sociotechnical approaches to work organization possible.

5.5 Macroscopic Methods

The framework for analysis used in this report considers three levels of impact: the macroscopic societal level, organizational level and individual level. Macro level impacts were associated most often with economic studies, women's studies, technological change and labour relations. The most popular types of measures at this level have been those directed toward economic impacts, with particular emphasis on the labour implications and training requirements.

The measurement of employment impacts has been based on economic forecasting studies which, in most instances, examine the displacement impact resulting from the introduction of a particular technology. These studies generally are based on

aggregate models which examine particular economic sectors and attempt to project the changes in labour requirements.

At this level, models which have been applied include Delphi techniques, leading edge analysis and case studies. These examine, in most instances, trends in the acceptance of a technology among particular sectors of industry or a population.

5.5.1 Leading Edge Analysis

Leading edge research has been described philosophically as being based on the idea that in business, as in other areas of endeavour, a few large businesses account for a very large share of total employees, sales volume of other intrinsic characteristics of the system under investigation. Thus, when new innovations are introduced on a wide scale, it is recognized that certain leading edge companies are often the most relevant to investigate in order to gain an understanding of the probable impacts a new technology may have on a particular industry segment.

This approach involves a detailed assessment of the experiences of a selected group of leading edge companies who are utilizing the technology. In most instances, this approach aids in providing a preliminary picture of the early stages of product and service introduction. This can also be applied to individuals when specific target groups for an innovation can be identified.

Leading edge analysis has been used to obtain basic measures of interest, in a particular innovation such as usage, productivity gains and applications. These estimates are then scaled upwards according to some criteria of representation for a selected industry segment and for all segments in the country.

This type of approach is based on direct observation of events in selected industries, which have been defined according to their role in the industrial community as a primary source for the further diffusion of practices throughout the country, region or across industry segments. The approach relies, for the most part, on trend extrapolation from a limited base of primary data collected in some modified field setting.

Limitations on this approach lie in the a priori selection of so-called leading edge companies and the generally non-rigorous approach to the measurement of impacts. Trend extrapolation of impacts throughout the population is restricted since the base for the projection is not representative of particular population segments, and further, the models for extrapolation cannot be adequately parameterized since the population is usually unknown. These methods, therefore, while being useful for new production evaluation, essentially remain as descriptive techniques useful more for assessing demand than for evaluating impacts, particularly those of a social nature which often require long-term observation and controlled measurement.

5.5.2 Delphi

Often, when new technologies and innovations are being considered for implementation in a particular setting, concensus opinion techniques are applied to anticipate the possible effects of an innovation. It is not uncommon, for example, to find examples where so-called experts or seers are asked to consider a new innovation and to assess the probable impacts of its introduction. The impacts could be economic, social, political or technical. Delphi is one technique for soliciting opinion through the use of questionnaires whereby the researcher determines the experts' expectations and then compiles these in some sort of quantitative indication of central tendency. These responses are then returned to the experts who are asked to compare the median response to their original responses and either shift their answer or explain their reasons for differing from group concensus.

The Delphi technique has been found to be useful for obtaining opinions from experts but much less successful in providing accurate predictions about the direction and impacts associated with a particular technology. This has been found to be the case, particularly where there were no acknowledged areas of expertise, and where little experience or familiarity with a new technology exists.

A list of the basic shortcomings of this approach* has been provided in a report provided by Bell Canada:**

a) The concept of expert is virtually meaningless in experiments dealing with complex social phenomena.

b) Sole or primary reliance on expert opinion in the social sciences has long been discredited and now has very few serious advocates.

c) Anonymous panels chosen in unspecified ways enhance the possibilities for elitist expert samples.

d) There exists an uncontrolled and unknown expert halo effect in Delphi contributing to expert oversell. Collective expert opinion enforces unaccountability for the Delphi results for all concerned.

e) Experts and non-experts consistently give indistinguishable responses in forecasting or evaluating social phenomena impacting on common values and attitudes.

f) There is no explicit matching of skills required by Delphi questions against objectively measurable skills of panelists.

The Delphi method has generally been applied to identifying macro-level impacts such as changing labour force and skills requirements and developing future scenarios. These have, for the most part, been part of the "future" forecasting school which provides qualitative judgments of the likely occurrence of specific events over a time period. The limitations of the technique and its inherent bias restrict its use in economic forecasts, and as suggested previously, also render it unsuitable for attempting to deal with new technologies. The experiences of using the technique in attempting to identify social impacts has not been very successful. These limitations render it of very little value for assessing social issues and, therefore, for providing a useful method in assessing the social impacts of new office technologies.

* Suckman, (April 1974).

** Business Planning Group of Bell Canada, (January 1976).

5.5.3 Case Studies

Macro-economic impact analysis can be based on qualitative or quantitative analysis. A recent study prepared for the Department of Communications indicated that quantitative measures of impacts have been carried out using a partial equilibrium framework. The impacts identified in that study were generally defined as "net" impacts, which translated to some level of unemployment. More specifically:

> "The ultimate impact of a technology is viewed as the displacement of workers, who ... constitute a growing stream of new entrants to the pool of the unemployed."*

The approaches used typically rely on the case study method. Limitations of the relevance of such approaches have been outlined previously but for the most part focus on the need to select appropriate cases and the over-reliance on assessing the negative impacts, i.e. employment displacement.

It was suggested in the DOC report that, at the present time, macro-economic impact assessments of new technologies are not feasible. This is primarily because of the need to collect more and better information at the micro-(user) level and at the macro-(industry) level. Case studies have been proposed as the most feasible approach for identifying a particular industry and determining the specific technologies which it has, those it is most likely to adopt, and to assess the impact of these technologies. It is suggested further that micro-level analysis should identify the nature of the technology, the amount and timing of the required investment, and the impact on labour requirements. In order to be meaningful and to feed into the macro-level assessments, the case studies should be of sufficient size to provide inputs for an impact analysis model.**

* Ruddick, E., Sonnen, C.A., (1980), p.2.

** In the study cited, the T.I.M. model is described. This is a macro-economic model of the Canadian economy using seven basic sectors of the economy.

Globerman (1981) recently conducted a study which examined the adoption of new computer technology in four service sector industries. The approach was primarily oriented toward the determinants of the adoption process for automation with some attention directed to examining the employment implications of that process. The study utilized an in-depth analysis of the four specified segments of the service sector. The method relied on the re-analysis of relevant information from published reports rather than on the collection of *primary information* using in-depth interviews or surveys at the company or organizational level. As a result, many of the models derived for that study were based on data which were somewhat outdated and which required a significant number of assumptions to be made with respect to its representation of the industry sectors under investigation. Time limitations were also evident where, as Globerman (p. 41) points out, the information on automation adoption in the sample sectors was available only for specific points in time. Thus, the ability to model a diffusion rate as a continuous mathematic function was severely limited. It is worth noting a major limitation in this study resulted from the reliance on published secondary data. This was insufficient to permit precise measurement of the relevant variables for analysis in the proposed model.

Macro assessment studies typically rely on broad based data, and as a result will be subject to error simply as a function of the increasing levels of aggregation required in such analysis. Thus, their use for assessing the social effects, which in this case can be defined as employment displacements, should proceed with caution and be supplemented where possible with primary data gathered at the firm or individual level.

5.5.4 Time/Activity Analysis

Macro-level societal changes resulting from the introduction of new technologies have been assessed in some instances using time and activity analysis. These types of studies have, for example, examined such issues as the transportation-telecommunications* trade-off effects resulting from the automation of office functions. In these studies, such factors as the changing requirements for travel and the decentralization of work locations have been common themes.

Surveys of travel and communication behaviour constitute the prime data gathering technique in these types of studies. The data is generally collected over several time periods using a longitudinal framework, and then subjected to analysis utilizing a variety of modelling techniques. These models are usually economically based and in principle seek to assess the net change which occurs in the expenditure of time and money for the accomplishment of some task such as journey to work. As such, they are based on measures of efficiency and utility, and are closely aligned to measures of productivity gain and efficiency.

One specific structural change which relates to the macro-level concerns of this study is external decentralization. This has clear implications to society in terms of the energy requirements for travel. Studies reported by Kohl et al. (1975) used a process approach and measured internal and external communication needs and processes in order to identify which organizational components could be shifted to rural areas. Other approaches to measuring this effect have used cost benefit analysis.

* Examples include: "The Social Effects of Communication Technology", Rand Corporation, and "Transportation Communications: Some Broad Considerations", IEE Transactions on Communication Technology, Vol. COM-16 No. 2, 1968.

Descriptive studies of time use have addressed such issues as the daily time allocated to specific tasks for individuals or work units. Examples of such studies are those by De Grazia (1962) and Neulinger (1973). More recent work in this area attempts to view time and activity phenomena in a systematic way, and introduces the concept of processes and an interaction phenomena within a population or sub-group. A strong reliance in these studies has and continues to be based on the traditional time budget survey methods.

Limitations on that approach include:

a) The time-budget survey often uses debatable sampling techniques and aggregation methods, which divorces time use from interaction, group formation and time allocation in populations. It becomes nearly impossible to determine casual structural relationships.

b) The short time perspective and concern with "average" days neglects the structural implications of various time spans which are sub-sets of one another, e.g. how days are parts of weeks, or years are part of life (cycles).

c) Time use is not seen as a component in longer term projects.

d) Time use surveys deal with actual behaviour as exhibited in ex-post-analysis, while alternative choices and options are never registered since alternatives not chosen are a form of non-behaviour which are less susceptible to crude observation and which must be deduced from situational premises.

e) The lack of consideration of the physical environment has numerous implications in that actual behaviour studied is already adapted to a particular environmental setting.

f) Since so little of the environment which constrains and generates particular behaviour and activity programs (and projects) is considered, time use studies can provide little but crude guidance on how the environment should be changed to promote certain forms of time using activities. Hence, such studies are inherently more powerful in detecting symptoms than in rectifying problems.

5.6 Organizational and Individual Level Measures

5.6.1 Network Analysis

Network analysis has recently emerged as a method which offers potential to assess the impact of new technologies in particular environments. The methodology attempts to define linkages between individuals, workstations or organizational units based on interactions. Network analysis has been used to define the characteristics of the interaction as well as the complexity of sets of interactions. In many instances the assessments have been used as a basis for defining the structural properties of organizations. For example, Conrath (1973) suggests that organizational structure can be considered as a set of communication network relationships among organizational members. Communications of office automation technologies can affect structure, in terms of how one user relates with another. It is suggested that computer functions which affect only an individuals' task process would be likely to have much less effect on organizational structure than would functions (such as computer conferencing, electronic messaging, data synthesizing) which affect between person task processes.

A review of network analysis techniques in communication reveals this to be one of the more contemporary approaches to assessing the impact of new technologies at the micro and organizational levels. The use of network analysis reflects a distinct shift to understanding the value of considering relationships engaged in a

process of convergence rather than only isolated individuals. The value of this approach is what it offers in looking at relational communication processes and in understanding the organic processional nature of human systems.

Network analysis, as applied in communication research, can be examined according to: static comparison approaches, deterministic approaches and probabilistic approaches. A critical element in the use of a network methodology, therefore, is based on the issue of time and the basic underlying principles of the models being employed. That is, whether one is merely describing events or whether some set of relationships is being established. In a probabilistic or stochastic model, a set of events is considered to follow a defined distribution and the events are predictable. The approach assumes that not only can we not measure and specify perfectly, but more importantly, many network behaviours are not strictly determined but rather involve some randomness or distribution of alternative possibilities.

Static comparison approaches include relational networks at the individual, group or system level. Individual level analysis is usually based on an anthropological perspective. In these types of studies there is often a focus on time use for individuals in specific environments, i.e. offices, corporations, households, etc. Techniques rely on observation, recording and aggregation of time allocation. There may be attempts at establishing relationships between measures using frequences and correlational analysis. In some studies, relational variables have been correlated and plotted with each other across time to show, for example, how later relationships associate with current communication strength or the number of links between individuals (Hammer 1980). Other techniques applied in this type of study include repeated measures analysis of variance. Q analysis (as described by Rice 1979 - an algebraic-topological portrayal of relations) and multi-dimensional scaling to define groups or clusters resulting from communication linkages.

System level analysis has been made by using matrix analysis. In such studies, a matrix of interactions (a whom to who matrix) can be constructed and subjected to various types of contingency table analysis such as logit analysis or more simply chi-squared. Other approaches to the evaluation of over-time networks of the same individuals involve the covariance matrix derived from the initial link or distance communication matrix (Somers 1979).

Deterministic approaches in network analysis have been classified by Rice (1981 p. 7) as covariance-based approaches and structural control approaches. Time series and regression analyses are two methods which have been applied to defining communication networks and for assessing change or impacts in a given group or population over time. Critical problems in these types of approaches centre on the large number of time periods necessary to gain a meaningful series of observations. (This is particularly problematic in tracking human behaviour.) An alternative, however, is to use automatic tracking and monitoring of events rather than only relying on individual reports of behaviour. A second problem inherent in such approaches is the unit of time which is used to observe events. This is commonly referred to as the "window" with which events are measured. A very fine window increases the data requirements, while a very broad window introduces the problem of aggregation.

Rice (1981 p. 10) also reported on a series of attitude change experiments using metric multi-dimensional scaling which were referred to as dynamic in nature, and which have been applied in studies evaluating the communication processes and the changes or impacts resulting from the introduction of new technologies to facilitate that process.

Probalistic approaches for assessing the impact and analysis of communication have been classified as information flow approaches and Markov chain approaches. These methods have been applied most often in the areas of diffusion, structural information and stability modelling. These models and approaches consider networks over time and seek to define the likely outcome in a system from one time period to the next. The majority of work using these types of approaches have been applied to the analysis of interpersonal and mass communication mediation.

Interpersonal associations in organizations or broader societal settings can be impacted quite significantly with the introduction of new technologies, and as such these approaches are considered relevant to the assessment of social impacts. Thorngren (1977), for example, in assessing the social impacts of the telephone, notes that what is important is the close relationship between different media that form part of a joint multi-media, multi-person network connecting large segments of society over long periods of time.

Stochastic modelling approaches to the analysis of networks for communication and interaction over time are gaining increased attention. Markov chain analysis represents one such approach. The essential aspects of this approach are its reliance on defining elements, processes, states for the elements and transitions in the relationships between elements over time.

> "The process remains in a specified state for an exponentially distributed length of time, with a rate dependent only on the state. Immediately thereafter, a transition is made to another state, with a probability that depends only on the present and transited state."*

* Rice (1981).

Markov chain approaches have been used for assessing a variety of communication processes where network formations can be defined. Networks can be defined on the basis of interactions such as through conversations or through electronic means, e.g. computer-based conferencing or teleconferencing. Networks are defined to be in some state, such as those defined by Katz and Proctor (1959); mutual choice, one-way choice and null choice. Application of the Markov process considered how different time intervals affected transition rates through the specified states for the network.

Rice (1981 p. 13) has pointed out some of the problems inherent in the application of Markov models to communication research:

a) The need to assume a homogenous population.

b) The assumption of constant transition rates through time.

c) The need to collect data from very small sampling units.

d) The requirements for the transition matrix to be embedded in a more fundamental matrix.

These represent only a partial list of the more fundamental issues related to the use of this method for analyzing and assessing the effect of new technologies.

The applications for the Markov analysis have been expanding, with the result that new variants are constantly being devised which modify some of the more stringent assumptions associated with the original applications. These approaches typically use rather complex modelling procedures such as linear and stochastic differential equations, and therefore require a certain skill at mathematics and quantitative modelling in order for them to be understood.

The network based approaches to assessing the impact of communications are fundamentally time based. Time is important as a unit of measurement, as an interval of observation and in terms of the duration of measurement. Data collection techniques rely very much on survey and self report time activity

diaries. With the introduction of computer mediated communication, the possibilities for collecting actual behavioural information rather than relying on perceptual information and reported behaviour are enhanced. That development is likely to provide better opportunities for modelling the relational properties which exist and develop over time, and for conducting unobtrusive longitudinal measurements. These capabilities will provide better opportunities for the application of network models and for understanding the characteristics of the communications environment within organizations and broad industry sectors.

5.6.2 Evaluation and Assessment Methods

In a review of research methods in communication studies, Tyler (1978) has pointed out that studies to assess effectiveness and acceptability have generated more use-oriented research in telecommunications than any other. These have made use of a variety of social science instruments such as controlled psychological laboratory experiments, experimental and quasi-experimental field trials and statistical and survey research.

The purpose of this section is to review the strengths and weaknesses of these types of behaviourally based effectiveness and assessments methods, and to consider their utility for measuring social impacts as defined in this study.

Included within the parameters of assessment models are:

a) Human Factors, Ergonomics
b) Laboratory Experiments
c) Field Trials
d) Retrospective Surveys

Tombaugh (1979, p. 9),* in reviewing various methodological issues for field evaluation studies, provides a number of insights into the criteria necessary for selecting an evaluation method. An essential part of any evaluation is the

* Tombaugh (1979) provides a comprehensive review of how to select an evaluation method as well as a discussion of issues related to scale construction, survey techniques and study design.

selection of good, dependent variables which are sensitive, reliable and valid. The selection of a method to evaluate a given service or program requires a careful assessment of the validity of the experiment. Consideration must also be paid to internal and external validity. Tombaugh, in reviewing Cook and Campbell (1976), has outlined the threats to experimental validity and illustrates quite clearly the difficulty inherent in the conduct of any field experiment based either on experimental or quasi-experimental design (see Exhibit 5-3).

For each of the specified problem areas, criteria can be defined to overcome specific problems, but in doing so a relaxation of certain assumptions is required. That generally denotes the movement from true experimental designs to quasi-experiments, and ultimately case studies. In reviewing the various design options and possible problems associated with each, there is a constant need to identify clear hypotheses for testing and as well to be aware of the weaknesses of each approach.

In selecting a design, the variations are, as Tombaugh (1979, p. 16) states, endless, depending to a large extent on the experimental situation, the availability of measures and the ingenuity of the researchers. Other concerns are the possibility for measurement and the ease and cost of data collection and data analysis. The variation of approaches possible for experiments in field settings are outlined in Exhibit 5-4.

The types of methods which bear most relevance to this study are field trials and retrospective surveys. The other two represent very important areas of investigation, but generally are applied to problems which are outside of the realm of social impacts. Human factors or ergonomics typically employ controlled laboratory experiments for the testing of the way individuals interact and respond to specific design and operating features of a new technology. While it can be argued that problems or difficulties in interacting with automated office equipment may have social ramifications, that type of concern is most appropriately dealt with in human factors research. As a result, human factors research is not dealt with to any extent in this review, although it is recognized as a critical area.

EXHIBIT 5-3

THREATS TO EXPERIMENTAL VALIDITY DESCRIBED BY COOK AND CAMPBELL, 1976

Threats to Internal Validity

History
Maturation
Testing (order effects)
Instrumentation
Statistical regression
Selection
Mortality
Interactions with selection
Ambiguity about the direction of casual influence
Diffusion or imitation of treatments
Compensatory equilization of treatment
Compensatory rivalry
Resentful demoralization of respondents receiving less desirable treatments
Local history

Threats to Statistical Conclusion Validity

Low statistical power
Fishing and capitalizing on chance to inflate error rate
Measures of low reliability
Random irrelevances in the experimental setting
Random heterogeneity of respondents

Threats to Construct Validity

Inadequate pre-operational explication of constructs
Mono-operation bias (using single example of IV or DV)
Mono-method bias (using some means of presenting treatments or recording responses)
Subject bias - Hypothesis guessing
Subject bias - Evaluation apprehension
Experimenter expectances
Poor selection of levels of independent variables
Faulty generalizing across time
Interaction of procedure and treatment

Threats to External Validity

Interaction of treatments with treatments (carryover effects)
Interaction of testing and treatment
Interaction of selection and treatment
Interaction of setting and treatment
Interaction of history and treatment
Faulty generalization across effect constructs

* Tombaugh 1979, p. 15.

EXHIBIT 5-4

Classification of Typically Used Field Research Approaches

	Intensity of Observation		
	After Only	Pretest Posttest	Interrupted Time Series
TRUE EXPERIMENTS	Randomization and manipulation of independent variable		
Randomized group designs	R X O R O	R O_1 X O_2 O_1 O_2	R O_1 O_2 O_3 X O_4 O_5 O_6 O_1 O_2 O_3 O_4 O_5 O_6
QUASI EXPERIMENTS*	Only partial control through randomization and/or manipulation		
Non equivalent (NE) designs	Selection threat is typical problem		
NE Control Group	M X O M O	O_1 X O_2 O_1 O_2	O_1 O_2 O_3 X O_4 O_5 O_1 O_2 O_3 O_4 O_5
NE Pretest		O_A X O_B O_A O_B	O_{A1} O_{A2} X O_{B1} O_{B2} O_{B3} O_{A1} O_{A2} O_{B1} O_{B2} O_{B3}
NE Dependent Variable	M X O_A O_B	O_{A1} X O_{A2} O_{B1} O_{B2}	O_{A1} O_{A2} X O_{A3} O_{A4} O_{B1} O_{B2} O_{B3} O_{B4}
Cohort designs (NE Time of test)	X O	O_1 X O_2 O_1 O_2	O_1 O_2 X O_3 O_4 O_1 O_2 O_3 O_4
Replicated designs (NE Time of treatment)		O_1 X O_2 O_1 X O_2	O_1 O_2 X O_3 O_4 O_5 O_6 O_1 O_2 O_3 O_4 X O_5 O_6
Single Group Designs	History, maturation, testing, regression threats are typical		
Single treatment	M X O	M O_1 X O_2	O_1 O_2 O_3 X O_4 O_5 O_6
Replicated treatments (Reversal designs)		O_1 X O_2 X O_3 X O_4	O_1 O_2 X O_3 O_4 X O_5 O_6 X O_7 O_8
CORRELATIONAL DESIGNS	Independent variables measured not manipulated		
Theoretical and Statistical Approaches	Structural equation techniques (path analysis)	Cross-lagged panel techniques	Interspersed lagged regression

* Designs marked with a M are excluded from the quasi experimental design class by some authors (Kenny, 1976, Campbell and Stanley, 1966) and considered generally uninterpretable quasi designs by others (Cook and Campbell, 1976).

5.6.3 Laboratory Experiments

Laboratory experiments offer a number of opportunities to study fundamental communication processes. These usually involve a controlled testing of specific hypotheses concerning interaction and communication within an artificially defined setting. As reported by Hough (1979, p. 60), these types of studies are useful where context or environmental factors are not crucial. Where contextual factors are very important, the truly experimental method has only limited value.

Where assessment of the acceptability and relative merits of specific system features are required, as in studies of product enhancement, these approaches have also been evaluated quite favourably and are regularly used in design research. Their value is enhanced in any investigation where there are specific hypotheses to test, provided that the activity can be simulated.

Tapscott (1979, p. 3) considers the main limitation of laboratory research to be:

a) the limited scope of the laboratory to recreate important aspects of the office environment;

b) limited external validity and generalizabilty of findings;

c) the current early stage of hypothesis formulation, making it difficult to test precise hypotheses;

d) problems obtaining appropriate sample respondents; and

e) the time required for individuals to become proficient with the operation of a specific piece of equipment.

Consideration of controlled laboratory experiments for assessing social impacts renders this method of dubious value. That stems essentially from the nature of impacts to be measured and the fundamental need to allow the context of the organizational setting to be part of the evaluation. Time also is an important consideration since there must be sufficient experience with system operations

and system interface to allow aggregate patterns of behaviour to emerge and be observed. Finally, social impact assessments require numerous examples to be studied so that adequate amounts of data can be collected in order to confirm the emergence of a social phenomena or measurable social impact. As a result, while laboratory studies are an excellent method for assessing the response to system features at the product development stage, or for testing hypotheses about the physiological and psychological response to technologies, they have not proven to be very successful or used very often in social research. (A detailed discussion of issues related to experimental design and laboratory experiments can be found in Thomas Cook and Donald Campbell's Quasi-Experimentation Design and Analysis Issues for Field Settings, 1979, and Experimental and Quasi-Experimental Design for Research, D. Campbell and Julian Stanley, 1963.)

5.6.4 Field Trials

Field trials offer an opportunity to evaluate new technologies within the context of a real world setting and with individuals who are actual users of the technology. These may be, for example, knowledge workers using management workstations, clerical workers using word processors, or operators using automated switching equipment.

Field trials may be designed or implemented as true experiments in field settings, quasi-experiments or non-experimental designs. The latter approach is more often considered as the case study approach which is typified by very little or no control exercised in the assignment of subjects to groups and in the use of control and test groups. Experimental designs are typified by full control over what items should be measured and a specification of test and control groups. Quasi-experimental designs allow partial control, but differ in the lack of random assignment of subjects to groups. These usually include:

a) a control group;
b) the specification of a test of treatment group;
c) the application of pre-trial measures; and
d) the observation of post-trial results.

Tapscott (1978, p. 3), in proposing methods for assessing the impact of office communication systems, suggests the most appropriate designs tend to fall in the area of quasi-experimental field trials. The strengths of that design rest on its ability to eliminate many of the threats to internal and external validity which stem from history and selection. As a result, it is possible to indicate that observed differences between experimental and control groups at the time of a post test are to some degree caused by the experimental treatment.

As part of the proposed evaluation procedure, several elements are outlined:

a) Tracking of usage characteristics, log-on time, commands used, etc.

b) Pre-experimental survey of management perceptions of specific items relating to improvements in organization.

c) Structural interviews held midway between pre- and post-tests to assess initial user progress in learning about the system, etc.

Specific measurement instruments included:

a) a pre-test organizational effectiveness questionnaire;
b) an extensive survey questionnaire;
c) a network interaction analysis form;
d) a method of system monitoring; and
e) structural interviews.

In reviewing the results from the application of this approach, positive effects were ascribed to:

a) improving communications;
b) time use;
c) access to information;
d) attitudes toward office system technology; and
e) quality of working life.

Attitudes toward technology and its potential benefits became more positive. There was a positive increase in the opinions and abilities of fellow workers to use an on-line office system in their day-to-day work.

There were, as well, positive responses observed toward quality of working life issues, such as:

a) job variety;
b) job significance; and
c) desire to be creative.

The results reported by Tapscott (1980) from the BNR study indicated that the quasi-experimental approach can be adapted quite effectively for assessing particular attributes of office automation systems. This has been shown to be the case for a relatively small scale study with a restricted sample, where at least some controls can be exercised.

While this approach offers a number of opportunities to assess impacts of automation, a number of problems still remain. These stem essentially from the need to have numerous replications of field assessments in order to obtain results which can be generalized to some defined population. Specifically, the problem can be identified as:

a) The small sample sizes which are typically used in these studies.

b) The need to work with small units in order to maintain control on the various factors and measurements.

c) The need to define a time frame of observation which may not be adequate to allow the "novelty" effects to be overcome, or to ensure adequate familiarity to be fostered among users.

d) The need to replicate the experiments numerous times to obtain any concensus on issues, and to generalize to a given population.

e) The need to collect background information, particularly of a socio-demographic nature, in order to provide possibilities for generalizing to populations of users.

f) The need to allow adequate time for attitudes and perceptions to be changed as a result of working with office automation equipment.

g) The need to consider numerous alternative organizational structures to validate research findings in different environmental settings.

In considering the quasi-experimental approach, it is clearly appropriate for overcoming a number of limitations inherent in the use of more rigorous methods for assessing new technologies, or those which are based on case studies or post-test only designs. The approach may be more appropriate for evaluating responses to equipment performance, office productivity and organizational effectiveness than to providing answers to broaden social impacts and implications.

The value of these approaches to social research lies most clearly in the way insights are provided into what have been defined as rather complex issues. Attitudes toward technology, for example, cannot adequately be measured among a small group of subjects over a restricted time period, such as a few months. As well, assessing the likelihood for clerical workers to move more effectively through various job functions requires much longer time periods and may require tracking of individual work histories.

In assessing social issues, it is useful to consider field trials as providing insights into probable effects. These insights will have to be substantiated through numerous replicated experiments under a variety of conditions which are reflective of those existing in the workplace. Thus, sets of experiments need to be designed which use similar measurement techniques across and between various environments and organizational conditions. In addition, these types of findings may be usefully supplemented with broader based sample surveys of populations to gain insights into attitudes, behaviour and expectations about technologies. Alternatively, certain types of qualitative research could be used to supplement

the results obtained in the field tests, such as in-depth focus group research among workers within various types of firms and organizational settings.

An empirically based approach to measuring impacts in the office has been developed by Conrath (1979). The approach stems from three basic questions:

a) What do people do?
b) What do people think they do?
c) What do people think about what they do?

The underlying purpose of evaluation is to provide insights into understanding what goes on in an office and to provide a basis for measuring the impact of the installation of office automation technology. A reliance on attitudinal measures is implicit in Conrath's approach, with a corresponding concern for gaining a sense of the perceived impacts resulting from office automation.

The types of methods employed to gather information include:

a) a questionnaire about the use of support services;
b) a form on which to write down what one thinks one does;
c) a diary form to record all interpersonal communications; and
d) an interview procedure to obtain the details of individual tasks.

The support service information is used to determine the potential for some of the features that one would find in the first generation of office automation technology.

The task record is designed as a standalone instrument which should yield profiles of activity of white collar workers in terms of the frequency tasks undertaken as well as the total amount of time involved to obtain an indication of the network of work flow.

The diary form is a self report instrument which should provide an image of the organization's structure as it exists and as it is reflected in the communication networks actually in use. This type of log also provides measures of the number

of attempted interactions which were instituted but which ended in failure, i.e. those not connected.

The detailed task analysis represents a structured format for collecting data on the processes used to accomplish the task, where the tasks were performed and the types of support services which were relied upon.

This type of detailed empirical approach is useful for providing longitudinal measures for subsamples of individuals in office settings. Results are usually aggregated to provide an overall picture of an office or organization. The major problems associated with the application of these methods is the reliance placed on respondents to provide rather detailed self reports of their activities, attitudes and perceptions. Recordings associated with diary tasks typically require a commitment by the respondent and constant monitoring by the researcher to ensure accuracy. Where large groups of individuals are being observed, these tasks often become rather onerous to control. Other problems involve the task definition and the need to provide enough task options to capture the essence of the range of activities, while at the same time not being too detailed as to render the information intractable for analysis.

Utilizing network analysis requires a significant amount of data to construct the required interaction matrix. Important questions centre on whether samples are adequate or whether census of all individuals constituting the elements of the organizational network should be included in the data collection phase.

Implicit in the measures proposed by Conrath is a concern for the socio-psychological evaluation of workers' response to their environment. This is emphasized in the reliance on attitude and perception measures which represent a significant part of the empirical method. The use of the approach when combined with the types of quasi-experimental methods discussed previously offers some opportunity for assessing impacts attributable to the introduction of new technologies. When used in pre-post surveys or large scale cross-sectional sample surveys, they offer some advantages for social impact measurements over the more rigidly controlled small sample experimental approaches.

5.7 Survey and Correlational Studies

A final approach for evaluation studies involves correlational techniques. The requirements for this approach are the collection of data, either a pre- and post-test period or over some set time period, either in a cross-section fashion or longitudinal time series manner. Essentially, these involve surveys or tracking studies. This type of approach can be used in several ways, such as:

a) To collect information from a specified sample prior to the introduction of a technology.

b) To assess, in a retrospective way, responses to a given technology.

c) To provide a monitoring of background measures among a specific sample, such as attitudes, perceptions or demographics.

d) To collect stated behaviour with respect to technologies where unobtrusive measures may not be available.

Surveys and tracking data can be incorporated into quasi-experimental designs as collection methodologies or used in more simplified ways. This would, for example, be the case of a pre-post data collection or a post-test only exercise. Alternatively, surveys may be conducted across a variety of trial locations or within specific populations. The purpose of such studies would be to gain information which could be generalized across groups or among specific populations. These types of methods are most helpful in assessing the general attitudes and opinions individuals have about particular phenomena. They also are particularly useful for providing a sense to the researcher of what types of concerns individuals have toward services, service performance, expectations and work environments.

The application of survey research should be considered where generalizations to populations are desired. If that is the objective, there is a need to consider a range of associated issues, including:

a) survey methods;
b) population definition;
c) sample specification; and
d) sample selection.

In addition, statistical considerations become important where pre-post tests are being conducted and where the desire is to ascribe causation. Numerous techniques for analysis are available, which rest on the satisfaction of certain distributional properties. Where the same subjects are being examined at defined time periods, available techniques include:

a) analysis of variance;
b) covariance with reliability correction;
c) raw change score analyses; and
d) standardized change score analyses.

5.8 Conclusion

This chapter has examined the various methodologies which could be used to assess impacts resulting from office automation. The approaches include the empirically based methods for data collection and analysis, applied approaches such as quality of working life, and those which are more theoretically based, such as network analysis and field trials. The methods are drawn from several disciplines, including economics, sociology, social psychology and mathematics, and represent a cross-section of approaches which have been applied in communications research at the macroscopic societal level, the organizational and the individual level.

Evident from this review is the importance of selecting methods which are applicable to the types of questions being investigated. In the previous chapter the key social impacts were defined and focused on such items as job loss, occupational mobility and de-skilling at the clerical level, and job stress, career advancement and work design at the management level.

Social impact issues are complex and involve attitudes and perceptions as well as more tangible items such as equity of opportunity, job availability and work design. To adequately measure this range of items requires a variety of techniques, measurement instruments and design approaches for applying these measures. These issues are also not mutually exclusive and restricted to only the societal, organizational or individual levels. They in fact transcend levels and thus do not easily fit into one approach or another.

Time is one of the most important factors which dictate the type of approach which should be employed in assessing social impacts. Small scale experiments and cross-sectional studies provide opportunities for gaining insights into issues. However, to substantiate their existence requires either long-term measurement and tracking or numerous replications of measures among the defined populations. When replication of studies is required, factorial designs become critical in order to allow coverage of the various population subgroups and to enable the identification variations between and within groups. Tracking and longitudinal measurements are often very costly and generate a large amount of data which must be subjected to detailed analysis before results can be confidently reported. Measuring attitude change can only be accomplished over time with attempts to control externalities, which may impact on the formation of attitudes and perceptions.

Contextual or environmental factors constitute a second factor which must be considered in selecting a particular method. This is particularly relevant where casual relationships are desired and where specific impacts attributable to a particular type of equipment is the goal. Quasi-experimental field assessments are most appropriate. Their strength for obtaining such measures is offset, however, by the limitations on sample size and the length of observation time required to allow the attitudinal and perceptual change to occur. To date, there are no adequate standards for setting limits on "time" in non-experimental settings.

The quality of working life approach and sociotechnology offer a number of advantages to assessing automation impacts, particularly at the organizational level. The need to design assessments appropriately is still critical, but these

frameworks stem from a basic concern for the context of work and of the processes inherent in the office environment.

Assessing labour impacts and change in the work force at the societal level can be enhanced with case studies and firm level investigation. Within such studies, field tests may provide further support to probable effects resulting from a particular type of service configurations. However, only through detailed statistical reporting and analysis of those statistics will trends in the labour force be identified. The role of case studies and firm level investigations is to allow anticipation of probable impacts so that adequate time can be provided to develop alternative strategies, thus avoiding undesirable social consequences. Such approaches provide a setting for evaluating programs as well as technologies, and thus offer an opportunity to monitor responses to programs for training and skills enhancements.

Development of a particular approach to measuring social impacts in the office requires the consideration of a variety of frameworks, designs and measurement tools. Since social impacts are not easily defined or measured, and since there is a need to substantiate their effect through a population over time, there is usually a need to consider a number of measures for meeting the particular goals of a research program. Studies therefore may require, for example, at one stage the application of quasi-controlled field tests and, at another, either in-depth network analysis to define an interaction matrix or a cross-section survey to track attitudes and perceptions of workers toward technology.

CHAPTER SIX CONCLUSIONS AND RECOMMENDATIONS

A main purpose of this report is to identify areas where research appears most needed, so that efforts of the OCS program can be applied to best effect. In particular, research will take place accompanying a set of field trials which are part of the OCS program, offering an opportunity to examine issues in an applied setting. Since a number of trials are planned, comparisons will be possible. Many of the research efforts recommended in this study have a direct relationship to the field trial setting. It should be noted, however, that this section is written without details as to how the field trials will take shape, and only broad areas of research are identified here.

In the investigations of research concerning office automation which have formed the background of this report, problems have been frequently encountered: lack of data upon which assumptions of impacts are made; confused thinking about the issues themselves; and an uneveness regarding the importance attached to certain effects. Considerations of the impacts of office automation are at a fledgling state. In this context, further research is likely to receive considerable attention, and the research initiatives of the OCS program may readily become significant in this field.

Generally, the impacts of office automation may vary according to what functions the technologies will serve: whether new office technologies (1) are implemented to replace jobs and automate entire processes within the office; or (2) are used as tools for the office workers. In the first instance, employment impacts will result as jobs are reduced within firms and certain occupations tend to be eliminated. Also, in cases where jobs are partially automated, employees may experience negative worklife effects, performing a small number of tasks which the computer is presently incapable of handling itself. Several forms of office automation should be monitored:

- Replacement and partial automation of jobs as processes within the office are automated.
- The use of information technology as tools by office workers.

Different means of job redesign accompanying computerization should be explored to compare varying effects.

Organizational changes will take place as a matter of course as the technology is put in place, and will also occur in an unplanned (and often unforeseen) way over time after automation occurs. It is also possible to undertake job redesign at the time of automation in order to take account of specific social factors, for example as the sociotechnical approach proposes. The field trials may offer an opportunity to vary the organization of work and compare results in terms of both productivity and social variables.

The most positive scenario of office automation that has emerged during the course of this project is as follows: while considerable occupational displacement occurs, productivity gains are achieved, boring and repetitive work is reduced, occupational bridging shifts workers to new opportunity areas and positive job redesign results in an environment where all office workers ("knowledge workers", "administrative assistants", etc.) use information technology as multifunctional tools. In the most negative scenario, meanwhile, a few "knowledge workers" use information technology as tools, while clerical workers and white collar workers whose information handling functions are routine either lose jobs without finding alternative options, or perform partially automated jobs where variety is reduced and one has a sense of working only "for the machine".

In assessing which features of these scenarios appear most likely to occur and with what social costs or gains, research in the field trials offers an advantage over case studies in that such measures as occupational bridging and job design can be varied. The effect of varying organizational structures can be assessed through measurable impact variables, and control and test situations can be explored to separate impacts due to automation itself or to other related causes.

6.1 Issues Identified at the Macro Level: Recommended Research

Employment impacts have emerged in this study as a major concern. Exhibit 6-1 lists the issues affecting society as a whole which were discussed in Chapters One and Two. However, most reports which have drawn attention to the potential employment effects of automation are based on extrapolations from data which are highly debatable. The need for case studies is frequently noted, and a number of case studies are being undertaken by a Task Force on Microelectronics. While field trials will provide ground for case studies, it should be noted that the experimental nature of a trial combined with the government setting (where, for example, office workers are unionized), may limit the usefulness of these trials to generalize about employment effects.

Chapters One and Two have emphasized that, while there is debate as to whether or not job loss or gain will result from office automation, job displacement and occupational shifts can be expected. The critical issue now is one of occupational mobility -- specifically mobility between low and high opportunity areas of the information sector. The main points made in this report regarding employment are as follows:

1. Office automation is a major information sector event. Jobs will be reduced in occupations where information handling is largely routine and so can be automated; at the same time, new jobs are arising for professionals in computer-based "knowledge work".

2. Skill requirements often rise as a result of automation -- particularly the requirements to enter new knowledge-based work. Mastery of computer skills is becoming increasingly important. At the same time, in certain jobs a de-skilling effect due to automation is noted where work has been largely automated and few functions are left for the individual to perform.

EXHIBIT 6-1

LEVELS OF IMPACT OF OFFICE AUTOMATION AND ASSOCIATED MAJOR ISSUES

1. Macro Level - Societal Level of Impact

Major economic and social concerns:

A. Employment Impacts:

i. Effects on jobs

- layoffs
- jobless growth
- job displacement

ii. Effects on occupations

- occupational shifts
- occupations segregation

iii. Effects on skill requirements

- rising skill requirements
- emphasis on computer literacy
- de-skilling
- widening skills gap

iv. Increased job mobility

v. Dual labour market

B. Changed Social Patterns:

i. Reduced work time

ii. Changing meaning of work

iii. Work off-hours and work from the home

iv. Transportation/telecommunication trade-offs

3. Women in particular are subject to occupational barriers and are concentrated in the office in the clerical jobs most likely to be automated or bypassed by new information technologies. Women are also separated by a widening skills gap from new professional jobs, and experience little opportunity to retrain in a more opportune area.

4. Thus automation in the office may produce a dual labour market effect -- increasing job opportunities and raising skill requirements for "knowledge workers", and reducing jobs and de-skilling at the clerical level.

The research areas suggested by these points relate to both general investigations of the issues and to field trial studies.

a) General Research Recommendations

1. Studies are particularly needed on where new opportunities lie in the information sector. For example, a recent MIT study in the United States has examined the creation of jobs in computer-related occupations. A better understanding is required of where opportunities will be found, what skills are required, how market growth and occupational mobility can be promoted, etc. Also, as emphasized in Chapter One, the information sector needs to be better distinguished from the service sector for macroeconomic planning to clearly identify areas of future growth. Both policies for industrial strategy and policies to cope with the social adjustments (retraining, occupational shifts, etc.) that accompany industrial trends require a more specific comprehension of the information sector as a growth area at this time.

2. Employment effects of office automation should be examined in a more specific manner through case studies that draw upon a variety of industrial sectors and that include both large corporations and small firms. Small firms are proliferating, and their use of automation should be specifically examined. Automation and the organization of work in information-based firms (i.e. software houses, consulting companies, legal firms, etc.) is an important area for study.

3. Studies are required which examine occupational bridging, particularly concerning the provision of options for women now at the clerical/secretarial level. Such studies should include the identification of new work roles, the provision of retraining, counselling and financial support.

4. Studies of computer literacy and exposure to computers in educational institutions are needed to understand how well the education system is preparing young people for a work world where an emphasis will be placed on familiarity with computers. Examination of elementary and secondary school levels should be included, and male versus female usage of computers should be compared.

   Such studies could be complemented by general studies of attitudes to computers and automation in both the existing and the emerging work force.

5. Career attitudes among young women should be studied to ascertain the frequency of expectation of clerical work versus knowledge-based careers.

6. The extent to which both traditional education institutions and training programs address computer-related skills should be assessed.

   Male versus female participation in training programs in computer-related skills should be examined, and further analyzed to differentiate part-time versus full-time attendance; attendance in formal programs versus continuing education, etc. In particular, an attempt should be made to capture shifts in career paths made by individuals through self-development efforts. The incidence of clerical workers entering computer-related occupations through part-time studies should especially be examined.

The responsibility of the OCS program to pursue such general research is debatable. An investigation of occupational shifts in the information sector, for

example, falls more readily to other sections of the Department of Communications (e.g. the Telecommunications Economics Branch). Regarding occupational bridging, Employment and Immigration has begun some preliminary studies on: The Integrated Electronic Office and Women - Training Resources and Needs; Implications for Training and Career Mobility; and Skill Requirements for Women to Participate in the Electronically Integrated Office. The topic of student familiarity with computers may lie within the jurisdictions of provincial education ministries. Certain questions (such as point No. 2 regarding case studies of the employment effects of office automation) appear appropriate for OCS program research. In addition, a role seems to remain for the OCS program to pull together relevant research and relate it specifically to the case of office automation, and to promote such research if it is not being undertaken. This could be accomplished by various means -- through publications, a research conference or the organization of a co-ordinating group. The Human and Social Impacts Committee (which reports to the OCS Users Committee) may be an appropriate vehicle if equipped with a suitable mandate and sufficient support.

The remainder of this discussion of macro level issues relates to the OCS field trials as an opportunity for research.

b) Field Trial Setting - Recommended Research

1. Examination and measurement of the magnitude and type of the occupational shifts that occur as a result of office automation.

2. An examination of changed skills requirements analyzed under varying conditions of organization, structure, management control, size, type and previous levels of technological experience.

3. An assessment of the relative effect of office automation as it may differ between the knowledge worker and clerical worker sectors. In addition, investigations should assess the within group effects which are likely to occur in each of these two groups as a result of automation. (Knowledge worker effects, for example, may differ among professionals, middle level management and executive levels.)

4. The testing of alternative strategies in the automation of the office, to study varying results. In particular, occupational bridging measures (counselling, retraining, etc.) may be applied which may promote occupational mobility, especially among clerical workers who may find new roles as administrative assistants or information analysts or enter new occupations with computer skills acquired through retraining.

5. An investigation of potential new occupational roles created by the introduction of automation in the office, which could potentially provide new jobs for displaced workers. In particular (as discussed further below), the role of "information analyst" should be explored as an option for secretarial workers -- filtering and summarizing information for professionals and managers from information resources that are increased through new technologies.

6.2 Issues Identified at the Organizational and Individual Levels: Recommended Research

Regarding the issues identified at the organizational and individual levels, an extensive range of potential impacts were discussed in Chapter Two (see Exhibits 6-2 and 6-3). In some cases the relevance of these impacts will depend on the field trial setting. (Hours and place of work, for example, may not be changed in the field trials.)

As Exhibit 6-2 indicates, at the organizational level changes should be investigated concerning:

1. authority structures
2. organizational structures
3. hours and place of work
4. career pathing
5. work design.

EXHIBIT 6-2

THE ORGANIZATIONAL LEVEL

The Organizational Level

A. Management and Organizational Control:
   - i. Changed authority structures
   - ii. New forms of management
   - iii. Changed role of middle level management
   - iv. The use of measurement systems

B. Organizational Structure:
   - i. Removal of levels
   - ii. Two-tiered effect
   - iii. More contract work
   - iv. Changed importance of units

C. Changed Hours and Place of Work:
   - i. Shift work
   - ii. Off-hours work
   - iii. Cottage industry work
   - iv. Satellite work places
   - v. Work from the home

D. Career Pathing:
   - i. Managerial/professional employees
   - ii. Clerical workers

E. Work Design

EXHIBIT 6-3

THE INDIVIDUAL LEVEL

The Individual Level

A. Control:
   - i. Monitoring
   - ii. Pacing
   - iii. Autonomy: Decision making and responsibility
   - iv. Accountability
   - v. Worker participation

B. Nature of the Work:
   - i. Increased stress
   - ii. De-skilling
   - iii. Job interest/monotony

C. Job Meaningfulness

D. Career Development:
   - i. Appropriate pay and benefits
   - ii. Job security
   - iii. Opportunity to learn and develop new skills
   - iv. Opportunity to advance

E. Social Needs:
   - i. Communications networks
   - ii. Balance between work and home
   - iii. Provision of a group structure
   - iv. Privacy

F. Dependency on Technology:
   - i. Reliance on the machine
   - ii. Restricted range of information
   - iii. Beliefs and attitudes toward computer-based information

Observable changes should be mapped and employee attitudes should be sought, particularly through open-ended interviews. At the individual level, attitudes to a range of issues should be investigated relating to:

1. management and organizational control
2. nature of work
3. job meaningfulness
4. career development
5. social needs
6. dependency on technology.

Both positive and negative effects should be identified, and again open-ended interviews should be emphasized. The social questions among this range of issues which appear most important are:

1. Job Redesign

Job design and the organization of work appears as a critical issue. Many potential negative effects upon quality of worklife in the office has been associated historically with a particular approach to automation and the organization of work: the tendency to fragment jobs, isolating a process for automation and leaving bits and pieces of work for individuals to perform "for the machine". In contrast, approaches such as sociotechnology have emphasized task coherence, the use of work groups and the use of computers as a tool for individuals to accomplish tasks (rather than the use of individuals to fulfill parts of tasks which the computer cannot perform). This point pertains to all workers in the office and not only to "knowledge workers".

The process of automating in the office will necessarily involve both an unprecedented consideration of the workings of the office and some measure of organizational restructuring. The field trial setting offers the opportunity to explore contrasting approaches to the organization of work. As emphasized earlier, employment impacts, organizational effects and quality of working life effects can be compared.

2. New Work Roles: Information Analysts and Administrative Assistants

It is possible that information technologies may multiply the amount of information to be absorbed by knowledge workers. The term "information overload" has been coined to refer to the problem of a surfeit of information. New technologies increase the information available so that more information must be digested, weighed, placed in context, etc. A new role may develop of filtering, synthesizing and summarizing information for use by professionals and managers. Research in job redesign should specifically explore the usefulness of such an information analyst or information assistant role, and the feasibility of retraining secretarial workers to perform such tasks.

Administrative assistance is another role that has been frequently put forward as useful work for displaced secretaries to perform. This role should also be explored in job redesign.

3. Diverging QWL Effects

Just as a dual effect may be experienced regarding employment impacts (as noted earlier), it is possible that a disproportionate weight of negative effects of automation on worklife (i.e. reduced job meaningfulness, increased control by such means as monitoring and pacing, etc.) may be experienced at the clerical level. This potential diverging effect should be monitored.

4. Knowledge Worker Effects

Many of the gains of the new technology (conveniences, improved communications, etc.) can be expected to be investigated for market research purposes. The benefits of office automation as a multifunctional tool are most likely to be experienced by managers and professionals, and negative effects such as reduced job meaningfulness may be less probably among this population. The main potential impacts to be monitored among "knowledge workers" appear as follows:

i. Increased information load. New information technology may increase the amount of information to be absorbed by the knowledge worker. A surfeit of information is already a common complaint.

One implication of information overload, as indicated above, is the potential creation of new information-based jobs to assist higher-level knowledge workers by filtering, synthesizing and condensing information into concise useful forms. The possibility of retraining secretarial workers as such information analysts or assistants should be explored as part of job redesign research, as both a means to provide support for professionals and managers, and as an employment opportunity for displaced employees.

ii. Vulnerability of jobs to automation. It is still unclear to what extent lower-level knowledge worker jobs may consist of routine information-handling suitable for automation.

iii. Job stress. Stress may be heightened due to increased responsibility, increased accountability, adjustment to changed roles, work from the home, etc.

iv. Reduced opportunity for career advancement. Due to a decrease in middle management supervisory positions, traditional career expectations of advancement through a hierarchy may be frustrated.

6.3 Larger Policy Issues

Office automation has been viewed in this study as an event within the information sector, part of a trend whereby more routine information-handling tasks are automated while more complex information based jobs ("knowledge based" occupations, commonly reliant on computer technology) are created. The issue of occupational shifts (rather than job reduction or job displacement) is paramount. Occupational mobility becomes a primary social concern, particularly for clerical workers whose jobs are most vulnerable to automation and who also experience little occupational mobility. Because women are concentrated in

clerical/secretarial positions, office automation poses serious problems about future employment for the female work force.

In this context, the redirection of individuals to opportunity areas becomes central. Government actions are important in a number of ways:

1. Industrial strategy should be based on adequate data and analysis.

2. The public must be made aware of where new opportunities are expected. Clerical workers in particular and young women about to make career choices should have some understanding of the expected reduction in these jobs.

3. Training programs (whose past inadequacies and failure to train people with needed skills were discussed in Chapter Two) need to be attuned more effectively to opportunity areas.

4. Within the public service, job reclassification should be responsive to the creation of new roles through job redesign -- particularly information analyst or administrative assistant roles that could potentially provide opportunity for displaced secretarial/clerical workers.

5. Occupational bridging mechanisms must be developed to aid individuals. (A number of such mechanisms have been suggested* -- registered educational leave plans, counselling, support while training, etc.).

* For example, see Women and the Chip, pp. 75-80.

It is important that the needs of women at clerical levels are addressed. Chapter One discussed the possibility that a dual labour market may emerge, split along an axis of suitability to information sector opportunities. The current position of women in the work force places them in the less privileged group, vulnerable to automation and lacking skills for new "knowledge-based" jobs. The promotion of occupational mobility for women is particularly important.

In addition, computer literacy is becoming an increasingly important concern among those who believe that the most opportune occupations in the future will require an informed sense of the use of computers. Educational policy must respond to such new needs, and to the introduction of computers within educational institutions themselves. The present ad hoc treatment of computers in both contexts opens the possibility that students in different locations may receive a high unequal introduction to computers. Again, the scenario of a dual labour market (consisting of information sector "haves" and "have nots") should be avoided.

Finally, government must anticipate future problems concerning unions and the issue of protection of workers from technological change. As discussed in Chapter Three, there is a low degree of unionization among office workers, and furthermore there is little likelihood that technological change can be dealt with through the collective bargaining process alone. Pressure may be exerted upon government to deal with technological change through further legislation; to provide a "social net" for affected workers; or to supply new employment opportunities through economic policy. To avert problems, adequate liaison with unions, industrial strategies and occupational bridging will be needed.

The public service is the exception to the rule of non-unionization among office workers, with a highly developed union structure. Again, government will deal with office automation, as employer in this case. A further issue arises, that a gap may widen between protected public service employees and unprotected workers in the private sector.

The investigations undertaken in this report suggest a few broad policy goals that encompass most issues discussed here:

1. The promotion of a labour force equipped to take advantage of information sector growth.

2. The avoidance of a dual labour market scenario (split into information sector "haves" and "have nots").

The advancement of quality of worklife considerations has also figured in government policy in the past. The risks when such goals for the labour force are not met through some means include unemployment, skills shortages, labour disruptions, political pressure and the range of problems that accompany job dissatisfaction.

A Task Force on Microelectronics has been established at the time of writing of this report, which will deal with many employment impact issues identified here. Other task forces, committees and working groups within government, as well as individual officials with relevant responsibilities, are addressing policy issues related to office automation as well.

Increasing attention to office automation can be expected, and activities by many different parties will proliferate. Without co-ordination and synthesis, disjointed efforts may operate at cross-purposes, or fail to reach a critical mass, or lose sight of underlying objectives. There appears to be a high risk of scattered interest in diverse aspects of office automation.

In opposition to such scattered activity, this report has placed the issues that relate to office automation in a unified framework and considered office automation itself within the context of larger information sector developments. The importance of productivity in an industrial environment driven by rapid innovation, and by dependency on international markets amid intense competition, is reflected by the fact that few voices are proposing that automation be held back. There is also perhaps a tacit sentiment that many jobs which can be automated have proved poor or unchallenging for human beings. Meanwhile, the

same industrial context that exerts pressure to automate is creating demand for knowledge workers. With the educational infrastructure in place in Canada and the possibilities for its rapid expansion, it seems unacceptable that problems of both unemployment and skill shortages should co-exist, and yet they do, while accountancy programs are used as "screening devices" for crowded computer science courses. Changes in education and training are critical.

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APPENDIX I

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